GROUP INVESTIGATION AND NUMBERED-HEADS-TOGETHER LEARNING STRATEGIES, AND SENIOR SECONDARY STUDENTS' LEARNING OUTCOMES IN MATHEMATICS WORD PROBLEMS IN OYO NORTH SENATORIAL DISTRICT, NIGERIA

BY

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CERTIFICATION

I certify that this study was carried out by **Wasiu Atanda GAN1YU** with matriculation number **141544** under my supervision in the Department of Science and Technology Education, University of Ibadan, Ibadan, Nigeria.

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DEDICATION

I dedicate this work to almighty God and those that supported me in the course of my study

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ABSTRACT

Mathematics, a core subject in school, is indispensable in science and technology. However, reports have shown that many Senior Secondary (SS) students have poor learning outcomes in mathematics, particularly Mathematics Word Problems (MWPs). Previous studies focused more on home and students-related factors affecting learning outcomes in MWPs than on intervention using strategies. This study was, therefore designed to determine the effects of Group Investigation Strategy (GIS) and Numbered-Heads-Together Strategy (NHS) on SS students learning outcomes (achievement and attitude) in MWPs in Oyo North Senatorial District, Nigeria. The moderating effects of gender and Verbal Ability (VA) were also investigated.

The study was anchored to Social Development Learning and Social Interdependence theories, while the pretest-posttest quasi-experimental design using a 3x2x2 factorial matrix was adopted. Three Local Government Areas (LGAs) were randomly selected from the district, while three public SS schools were randomly selected from each LGA. An intact class of Senior School II students from each school was randomly assigned to GIS (225), NHS (190) and the control (172) groups. The instruments used were Attitude to Mathematics Word Problems Scale ($\alpha = 0.85$), Mathematics Word Problems ($r = 0.88$), Verbal Ability ($r = 0.81$) Tests and instructional guides. The treatment lasted 12 weeks. Data were analysed using descriptive statistics, Analysis of covariance and Bonferroni post-hoc test at 0.05 level of significance.

Participants' age was 15.48 ± 1.30 years and 54.7% were female. Students' VA (58.9%) was high. There were significant main effects of treatment on students achievement ($F_{(2;\ 585)} = 35.56$; partial $\eta^2 = 0.11$) and attitude ($F_{(2;\ 585)} = 30.87$; partial $\eta^2 = 0.10$). The students in GIS group had the highest adjusted post-achievement mean score (11.61) as against those in NHS (11.26) and the control (9.75) groups. The participants in GIS had the highest adjusted post-mean attitude score (111.81) as against those in NHS (111.44) and the control (103.25) groups. There was a significant main effect of VA on students' achievement ($F_{(1;\ 586)} = 33.89$; partial $\eta^2 = 0.06$). The Participants with high VA had higher post mean score (11.51) than those with low VA (10.24). The VA was not significant on students' attitude to MWPs. There were no significant main effects of gender on students' achievement in and attitude to MWPs. There were no significant two-way and three-way interaction effects on students' achievement in and attitude to MWPs.

Group investigation and numbered–heads-together instructional strategies improved students' achievement in and attitude to mathematics word problems among senior secondary schools in Oyo North Senatorial District, Nigeria. Mathematics teachers should adopt these strategies in teaching mathematics word problems.

Keywords: Group investigation strategy, Numbered-heads-together strategy, Mathematics Word Problems

Word count: 427

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Mathematics is a methodical application to most issues in life. It is universal to all learning and everyday living, whether a carpenter, farmer or a shopkeeper, an engineer or a scientist, a cook or a doctor, everyone needs Mathematics in his daily activities. Mathematics has been human companion since the beginning of human existence. It is a language that is universal. Not everyone is literate in French, Arabic, German, and even English but virtually everyone can count with the knowledge of mathematics. Mathematics nurtures some qualities like reasoning, problem solving, critical thinking and even creativity. It offers rationality to thought. Mathematical knowledge is needed in understanding the world in which we live and plays a critical role in comprehending the contents of other school subjects such as sciences, economics, social studies, music among others. Mathematics is the bedrock of science. It is the oldest of all sciences that have developed through the ages having a direct impact on the quality of human life.

Mathematics is the pivot on which technology revolves. It is the backbone of scientific and technological advancement. Its usage permeates every field of study including physics, geology, engineering, biology and medicine. Without mathematics, there is no science, without science, there is no technology, without technology there is no modern society (Salman, 2017). Mathematics can be divided into pure and applied mathematics. Pure Mathematics deals with concepts that focus on rules, proofs and so on. Applied mathematics is used in other subjects like physics, chemistry among others. It focuses on problem-solving approach.

Numerous developments in pure mathematics have led to a lot of revolution in electronics, information and technology which has greatly impacted on our society example is the Information Communication Technology (ICT) which has transformed the world into a global village (Amao and Disu 2012, Tadeu, Batanero and Tarman, 2019). Researches in geophysics especially in the realm of analysis and applied mathematics have led to some inventions like theories of automation, deep ocean currents, and magnetic field among others. Also, calculus which is an aspect of applied mathematics contributes in the manufacturing of supersonic jet and launching of satellites.

Mathematics is an indispensable subject in many fields. It produces skills needed in other subjects. It is an important subject in modern society. It is useful in schools, workplaces, businesses and for personal decision making (Hodanova and Nocar, 2016). Mathematics is the key to productive and fulfilling life and a great material to humanity. The relevance and usefulness of mathematics can never be overemphasised. It permeates all aspects of human endeavour (Abe and Egbon, 2012).

As a result of importance of mathematics toward nation building, the Federal Government of Nigeria made it a compulsory subject at all levels of 9-3-4 system of education in Nigeria as enshrined in the National Policy of Education (Federal Republic of Nigeria, 2004). Despite the relevance and central role, that mathematics plays, many students see it as a difficult subject. Many Nigerian students fear and dread mathematics because of seemingly abstractness of its concept. Students tend to respond to it with lack of self-confidence, negative feeling and anxiety. Mathematics is the most subject dreaded among students (Akinoso, 2011, Buckley, 2013, Taylor, 2010). Okafor and Anaduaka (2013) said that many students do not see the applicability of the subject to their lives and to the world around them, so they do not see reason why they have to trouble themselves with the subject that has no place in reality.

Mathematics curriculum has been a subject of controversy among teachers and all other stakeholders since the introduction of modern mathematics in Nigeria (Dan Etuk and Daniel 2013, Odia and Omofonmwan, 2018). They perceived the curriculum as foreign in nature which cannot adequately address the needs of Nigeria system. As a result of this, Mathematics has been more dreadful in the mind of students. This often

prevents the attainment of the objectives of the curriculum that provides the content which propels educational programme and practice.

Furthermore, Mathematics education in Nigeria is being confronted with problems like inadequate teaching materials and shortage of competent mathematics teachers (Suleiman and Hammed, 2019). These prevent the students from understanding and appreciating the subject even from the foundation levels. A teacher that is not well-versed in the knowledge of Mathematics cannot impart adequately the knowledge of Mathematics to students, thereby creating a gap between content and application. This invariably reflects on students' knowledge of applicability.

Furthermore, gross inadequacy of Mathematics teachers in the primary, secondary and tertiary level constitutes a greater challenge to mathematics education in Nigeria (Rogo, 2010). According to National Mathematical Centre (NMC, 2013), the ratio of mathematics Teachers to students in Nigeria is 1:35. A teacher may be conscripted to attend to a large number of students. In some cases, a school may not have a mathematics teacher at all which makes unqualified teachers to handle mathematics thereby leading to turnout of half-baked graduates. This makes the students to engage in examination malpractices to secure maximum grade not minding the outcomes.

The trend in the performance of candidates who sat for the West African Examinations Council between 2008- 2019 revealed a low performance in mathematics by the students. Students in the grades Al-C6 recorded 23% in 2008 which was an abysmal performance as shown in Table 1.1. There were noticeable improvements from the years 2009 to 2012 but again decline in 2013. From 2014 to 2016 the average credit pass was 34.67%. The best performance was in 2017 with the credit pass of 59.23% which is not too good for a nation that is aiming for a breakthrough in technology. The overall average performance of students who scored within A1-C6 from 2008 to 2017 was 37.39%. This implies students' performances in Mathematics are fluctuating.

Table 1.1; Analysis of West African Senior School Certificate Examinations in mathematics results from 2008 to 2019

NUMBER AND PERCENTAGE OBTAINING GRADE					
YEAR	**TOTAL SAT FOR EXAM**	**A1-C6 PASSES**	**% HIGHER PASSES**	**D7- F9 POOR PASSES**	**PERCENTAGE POOR PASSES**
2008	1,369,142	314,903	23.00	1,054,239	77.00
2009	1,373,009	425,633	31.00	947,376	69.00
2010	1,351,557	453,447	33.55	898,110	66.45
2011	1340,250	587,630	38.15	952,620	61.85
2012	1,675,224	819,390	48.91	855,834	51.09
2013	1343,683	555,726	36.00	987,957	64.00
2014	1,692,435	529,732	31.30	1,162,703	68.70
2015	1393,442	544,638	34.1	1,048,804	65.82
2016	1344,234	597,310	38.68	946,924	61.32
2017	1359,162	923,486	59.23	635676	40.77
2018	1,572,396	786,016	49.98	786,380	50.02
2019	1,590,173	923486	59.97	666,687	40.03

Source: West African Examinations Council, Yaba, Lagos.

These trends of poor result have generated a lot of concerns among teachers, government, parents and other Mathematics educator that are stakeholders. Scholars have attributed the abysmal performance to ineffective teaching methods (Pandey, Gegbe, Sundai and Sheriff, 2015) quality of instruction (Adegoke 2011, Podlasek and Pecjak, 2015, Amani and Arbabi, 2020), students negative attitude towards Mathematics (Karigi, 2015), lack of proficiency in the language of instruction (Abed and lord, 2011, Vijayan, 2016), perceived difficult nature of Mathematics (Bichi Yeping Li and Schoenfeld, 2019) among others. Solutions to some extent have been proffered such as the use of personalisation approach (Heng - Yuku and Howard, 2000, Awofala 2010), problem solving approach (Olaleye, 1997) mastery learning (Akinsola 1994) among others. Yet, students continue to perform poorly in Mathematics. The consistent areas of weaknesses identified are: Inability to translate word problems into Mathematical equations, inability to identify key words and irrelevant information among others as indicated by Chief Examiners Reports of a West African Examinations Council May/June, 2010. According to the reports, students demonstrated high level of inability to solve word problems. Also, the chief examiner's reports of 2011, 2012 and 2013, indicated that students lacked the capacity to translate expression into Mathematical statement. In addition, the reports stated that most students had problems in solving word problems

According to Nikmah, Juandi and Prabawanto (2019), some aspects of mathematical concepts are difficult for students to comprehend. Mathematical word problems, also known as MWPs (Bailey, 2012), Pearce, Bruun, and Skinner, 2013) are one of such aspects (Verschaffel, Stanislaw, Vandooren, and Star, 2020). Scholars have elaborate explanations for why students can't solve MWPs. These consist of lack of comprehension skills and a lack of previous experience with word problems (Mahofa, Adendorff and Kwenda, 2018), among other things. According to Odetola and Salman 2014), students make mistakes when solving word problems because they don't understand the language of mathematics, are not able to follow instructions, translate expressions into mathematical equations, or read diagrams correctly. Students are able to solve a variety of equations, according to observation and practice, but they are unable to solve the same problem in a word problem setting. It is assumed that students' ability to solve Mathematical word problems depends not only on their ability to perform the

necessary Mathematical operations but also on their comprehension of the problem's text (Jitendra and Star, 2012).

According to Rindyana and Chadra (2012), Seifii, Haghverdil, and Semmanill (2012), students who were unable to define the vocabulary in a word problem were unable to solve it. Therefore, the difficulty lies not in translation but rather in how students interpret vocabulary. According to researcher observation, word problems remain a problem for students in comparison to other types of mathematical problems. The difficulties are primarily brought about by linguistic factors, according to a number of recently published studies on this topic. Among the difficulties with language are: recognizing key words, locating relevant data, defining vocabulary, analyzing lengthy sentences, and comprehending the written context are all skills that can be learned (Gafoor and Sarabi, 2015). (Awofala, 2010, Dapaepe, 2010 Hickendorf, 2011, 2013). Although these strategies may have helped students learn some mathematical concepts, many of them did not address students' difficulties with word problems (Bush and Karp, 2013, Jupri Drijvers, 2016). Despite this, students still struggle with word problems.

According to Lublinski and Crane (2012), research has demonstrated that the manner in which a subject or course is taught by teachers or lecturers is likely to influence both academic achievement and attitude among students (Taleb, Ganbari, Yousefi, and Botlani (2018) (Kusa, Kavonius, and Aksela 2018).

According to Bayaga and Wadesango (2014), mathematical achievement is influenced not only by cognitive factors but also by affective factors like motivation, self-efficacy, beliefs, and attitudes. It is generally believed that students who have positive perceptions of the learning of mathematics indirectly develop a positive attitude toward mathematics, which may result in higher achievement. On the other hand, students who have negative perceptions of the process of learning mathematics frequently develop a negative attitude toward the subject, which may have an impact on their learning and performance (Mahanta, 2012; Mensah, Okyere, and Kuranchie, 2013).

According to Joseph (2013), a negative attitude hinders effective learning, which in turn affects LO (Achievement and attitudes) and performance. Wakhata, Mutarutinya and Balimuttajo (2022), observed that some secondary students perceived mathematics to

be abstract, difficult to understand, boring and having little or no relevance to everyday life experiences which may result to their lack of motivation and self- confidence in solving problem. Students have a negative attitude toward Mathematics despite its importance. The fields of Mathematics and science are typically thought to be dominated by males. Even teachers sometimes have a tendency to portray Mathematics as a male field.

Studies over the course of the past four decades have demonstrated that a variety of factors, which can be broken down into five categories: self, teacher, teaching, and learning; (Lawsha and Hussain, 2011; parent and peers, 2011, Marchis). An important factor that could affect a student's performance, particularly in Mathematics, is their attitude. According to Mensah and Okyere (2019), teachers' attitudes toward mathematics are influenced by the confidence and support they provide to their students.

Some Mathematics teachers tried out many student-centered instructional strategies in an effort to improve students' attitudes and Mathematics performance, particularly among MWPs (Salman, 1998, Awofala, 2010; Hickendorf; 2013; Boonen, et al). None of these studies used the Numbered-Head-Together (NHS) and Group Investigation Strategy (GIS) variants of cooperative learning, despite the fact that these researchers have conducted a number of studies on the effectiveness of learner-centered strategies on secondary school MWPs learning outcomes. As a result, educators in Mathematics have called for a paradigm shift in pedagogy. According to Olubela and Ajitoni (2010), despite calls for a shift in pedagogy, some secondary school teachers continue to employ conventional teaching methods over student-centered methods.

The conventional strategy can be used to handle large class and has the potential to cover large volume of materials within a short period of time, it assumes every student learns at the same pace without considering the students learning styles that are kinaesthetic (require movement of body to learn), tactile (hand-on-learner) among others. The teacher dominates the class and students are passive learners which prevent them to discover their strengths and potentials (Shivaramaiah, 2018). The teacher explains the idea that the class will be working on, and then shows the students how to answer the problem. According to Ajitoni and Olubela (2010), in a conventional method, most learning activities are concentrated on the teachers, while the students work individually

on assignment with interpersonal interaction discouraged. As a result of this, some scholars have submitted that lectures should be replaced with active learning and exploratory strategies (Salami and Okeke, 2017).

In view of the foregoing, cooperative learning is imperative. Cooperative Learning sometimes called small group learning. It is an instructional strategy in which small group of students work together on a common task. Each member of a team is accountable not only for learning what is taught but also for helping teammates learn, thus creating an environment of success (Kagan, 2002). Students work through the task or assignment until all group members successfully understand and complete it. Cooperative learning changes students and teacher's roles in classroom. Teacher's role in cooperative learning shift from knowledge transmitter to knowledge facilitator. Facilitating role means delegating authority to students and empowering learners so that students are able to make decisions and be responsible for their own learning. Also, teacher's play an essential role in helping groups function well through assigning roles, and giving necessary intervention as the students are working. Teacher also guides, encourages, explaining learning objective and criteria for success. In cooperative learning, the teacher observes, monitors how well groups are functioning. Above all, teachers assess and reflect on the whole process.

An important point to understand is that not all group works constitutes cooperative learning. Cooperative learning differs from other types of group work in two fundamental elements: Positive interdependence (This means that the students learn and ensure that others learn) and Individual accountability (specific role is given so that a student is not avoiding his/her roles and allow other to assume his/her roles. It comprises the following instructional models: Learning together, by David and Johnson (1994a, 1994b), student team learning by Slavin (1994) and his colleagues at John Hopkins University. Structural approach by Kagan (1994), Jigsaw by Aronson (1997) and his colleagues in Austin, Texas, NHS (Kagan 1985), think-pair-share (Lyman, 1981), GIS by Herbert Thelen, (1981), complex instruction by Cohen (1984) and her colleagues among others. Many studies have been carried out on cooperative learning strategy (Ning, 2010; Hossain, 2013; Al Barham, 2002). Extant literature has indicated that GIS and Numbered-Head-Together strategy (NHS) variants of cooperative learning have the

potentials of improving students' critical thinking and confidence in solving mathematical problem have been used in other aspects of mathematics but are yet to be used for teaching MWPs .

GIS was developed by Herbert Thelen in 1981. It was extended and enhanced recently by sharan and his colleagues at Tel Aviv University. Thelen sought for a learning situation that can be easily transferred later to a real life situation and full of inquiry. According to Thelen, in groups and societies a cyclical process exists. Individuals, interdependently seeking to meet their needs, must establish a social order and in the process they develop groups and societies. The class room situation is a replica of a society. The students of a classroom are conscious of standards and expectation that develops there. The teacher needs to maintain healthy social order. It is a classroom organisation where learners work together in groups cooperatively with the use of inquiry, collaborative planning, projects and discussion of students in groups. It is a students' centred approach where students choose the topic of interest for investigation, plan and carry it out, present and evaluate the results. According to Slavin (2009), GIS is a teaching and learning model whereby students of different academic abilities are placed into four or five groups. Each group is a mixture of high, moderate and low academic ability or variations of different ethnics groups, gender, racial and social group.

GIS includes four important components (the four Is): Investigation, Interaction, Interpretation and Intrinsic motivation. Investigation entails groups focus and process of inquiring about a chosen topic. Interaction entails that students learn and also ensures that others learn and explore ideas. Interpretation entails group synthesises and elaborates on the findings of each member to ensure proper understanding and clarity of ideas. Intrinsic motivation involves granting students' autonomy in the investigation process (Sharan and Sharan, 1992).

Implementation of GIS proceeds in six steps. The teacher presents a multifaceted problem to the students and students choose interest groups that scan sources, propose questions, and sort them into categories which become subtopics. The teacher then strikes balance between heterogeneity of the group and interest of the students. Second, groups plan their investigations and decide what they want to investigate and develop research questions related to the subtopics they have chosen. They think on how to answer the

research questions, they decide on getting the materials, online information and resources, textbook, and so on. The teacher divides the work among individual members or pairs. Third, groups carry out the investigation based on the assigned work. Group members gather, organise and analyse information from several sources. They collect their findings and form conclusion. Group members discuss their work in progress to exchange idea and information. They expand, clarify and integrate them.

Though every member has his/her own work but they can still help another person in the team. Each person writes the summary of their findings. Fourth, the groups explain their presentations. They determine the main idea of their investigation. Plan how to present their findings in a manner that can be easily understood by the class. They constitute a steering committee to conduct the presentation. The teacher teaches students presentation skills such as speaking clearly and concisely, capturing the audience attention by avoiding long lecturing and involving the whole class interactions. Finally, the teacher and students evaluate the investigation result and presentations. Achievement of individual and groups is assessed. Each group prepared questions that assessed both factual information and higher order thinking skills.

GIS provides a series of activities that facilitate students' critical thinking skills, especially opportunities to express their ideas and opportunity to ask questions (Chairunnisa, 2016; Meillia and Disman, 2016). GIS enhances better learning achievement in vocational subjects (Sangadji, 2016). Adejoh (2015) observed that GIS has the capacity to improve learners' performance in economics. GIS is a formidable strategy in teaching reading comprehension (Abdul- Gani, Asyik and Zaiyana, 2016). According to Mohammed (2018) Group Investigation learning strategy has a positive effect on students' ability and confidence in solving mathematical problem.

The numbered-heads-together (Kagan, 1985) was the second cooperative strategy experimented in this study. The member of the group usually comprises three to five students. The teacher would instruct the students to number themselves within their groups so that each student has a number 1, 2, 3, 4, 5. Students coach one another in solving the problem. Questions are posed by the teacher and then tell the students to put their heads together and make sure that everyone in the team knows the answer. Students discover the problem and solve it, making sure that every member can explain

the solution to the problem. The teacher calls a number (1, 2, 3, 4, and 5) indiscriminately and students bearing the number respond. Students become actively engaged with the problem. Every student has a keen interest in solving the problem because nobody knows the number the teacher would call. The strategy can be used when presenting a new type of problem. If students are unsure of which steps to use in solving a problem, they can put their heads together with their group's members to discuss different strategies or steps that could be used in order to find the answer and justify their reasoning as to why the steps will lead to the correct answer.

This strategy can also be adapted in mathematics by presenting a review problem and having student to collaborate with group members to come to agreement on the solution to the problem. Students' thinking can easily be monitored as students share out their group solution. The numbered- heads-together (helps students with special needs. After direct instruction of the mathematics, the group supports each member and provides the opportunities for practice, rehearsal and discussion of the content materials.

Also, NHS ensures positive interdependence because students are able to learn from each other. They must also work together to ensure there is one product to their learning. Also, students are accountable to each other for sharing ideas. It ensures equal participation of students within the group. The NHS enhances student motivation (Sutipnyo and Mosik, 2016; Novienaza, 2016), student self-regulated learning (Wijayanti, Roemint Oyo and Murwaningsih, 2017) and students' self-confidence (Putri Budiyono and Saputro, 2016). The NHS is applicable to teach many subjects for example, sciences (Asra, 2013; Yustitia, 2017). Social studies (Munawaroh, 2015; Maiz, 2015), Listening, speaking and writing skills (Mamman and Rajab, 2016; Sazwani, 2016).

In spite of the efficiency and wide acceptance of the strategy, available literature showed that it has been used in many subjects and some aspect of mathematics but are yet to be adopted in teaching of MWPs. Many factors other than instructional strategies which influence students learning outcome are of utmost importance to researchers especially Mathematics educators. These include ability to learn, academic self-efficacy, gender, social economic status, among others.

The academic accomplishments of students are influenced by gender. Numerous researchers have worked on it. Gender differences in mathematics and science instruction

among Nigerian and other students are mixed. According to Ogunleye and Babajide (2011) and Awofala (2011), gender influences male achievement in science and mathematics.Occasionally, to the advantage of girls (Brown and Kanyogo, 2010; (Robinson and Lubienski 2011). However, according to some studies (Okoye, 2010, Ghasemi and Burley, 2015), there is no difference between males and females in terms of attitude or achievement in various science subjects. Wasike (2013) found that girls have more negative attitudes toward mathematics than boys and the attitudes tend to get worse as student progress from elementary to secondary school. A few investigations have likewise shown that male students express more uplifting outlooks towards science than female students (Sax, Kanny, Tiffani and Whang, 2015; Sheldrake, Mujtaba, and Keiss; Federici, Tangen, and Skaalvik, 2015). Participation and performance levels among girls in education are low, particularly in the science, technology and mathematics fields. According to Hamilton, Mahera, Matenge, and Machumu (2010), Masanja (2010), and Zilimu (2014), SMT) is a major cause for concern. According to Lublinski Robinson, Crane, and Ganley (2013), girls have lower mathematics self-efficacy (self-confidence in solving problems related to mathematics) and higher mathematics self-concept (belief in their own abilities), as well as higher levels of anxiety and stress when participating in activities related to mathematics (Heckman and Kautz, 2014).According to Ross (2015), girls struggle with perfectionism and worry about their academic success.

In a bid to encourage equal participation of male and female in a classroom work and enhancing human development, efforts should be directed towards bridging the gender gap. The idea that mathematical knowledge is objective, rational and abstract rather than subjective, emotional and concrete contributes substantially to the gender gap. Gender differences in mathematics have remained a source of concern. In schools, it is the belief that mathematics is for boys. Many studies such as (Preckel, Goetz, Peckrum, Klaine, 2012) are of the empirical position that males are better in science and mathematics. Many reasons have been advanced for this; notable among them is external and internal factors. Internal factors have to do with biological, cognitive and affective factors while external factors have to do with classroom factors and so on.

Teachers sometimes linked students' success and failure in mathematics to gender. They perceive that the boys are better at Mathematics and that this differential rating of

boys contributes to gender gaps in Mathematics performance. However, teacher views are not to blame but reflect those of society as a whole, so teachers give more attention to male students in the classroom compared to their female counterparts (Kyei, Apam and Nokoe, 2011). Another myth is the linkage of mathematics to gene with male. This is seemingly a common misconception. Biological explanations have been offered for gender differences in chromosomes, hormones and brain lateralisation. Sociological explanations have been advanced on the differences in the socialization of boys and girls. Men and women also tend to prioritise different values when selecting a profession. For example, women tend to care more about working with people and men tend to be more interested in working with things which often results to gender gaps in selection of mathematics related- careers. Some researchers, such as (Ganley, 2018, Samuelsson, 2016, Rodriguez and Valle, 2020) among others have also found that boys tend to use more novel problem- solving strategies, whereas girls are more likely to follow school taught procedures. This tends to inhibit their Mathematics explorations and development of bold problem solving skills. Such differences may contribute to gender gaps in mathematics as content becomes more complex and problem situations call for more than learned procedures. Also, students 'gender differences appear to be suitable to a particular strategy in use. Some strategies may be suitable to either males or females. The gender was investigated to test its suitability on the strategies.

Another factor that has a strong influence on students' Mathematical performance is verbal ability. Verbal ability is the capability of a person to express his/her idea in a clear and understandable manner. It is the ability to write and speak well. Verbal ability is the cognitive ability to use and understand language. It influences the language ability of a learner. It entails both the vocabulary and the power to select appropriate words that will be meaningful to audience. According to Vukovic and Lesaux, (2013), Verbal ability is the ability of students in pouring knowledge and experience possessed in the form of adequate language to communicate others. Verbal ability comprises the oral and reading comprehension, speech fluency, spelling, grammar and solving of language puzzles like verbal ability anagrams and analogies. Verbal ability has a strong influence on students' achievement. According to Egbugara (2018), better verbal ability could result in higher

achievement in physics. High verbal ability students had higher achievement in biology than their low Verbal ability counterparts (Adejimi, Nzabalirwa and Shivoga, 2020). High verbal ability students outperformed their counterparts with medium and low verbal ability in Computer Assisted Pronunciation Teaching (CAPT) (Gambari, Kutigi and Fagbemi, 2014). However, Verbal ability does not have any effect on students' attitudes in some studies. Okere (2019), observed that verbal ability has no significant main effect on students' attitudes to literature in-English. Verbal ability has no significant effect on pre-service teachers' performance and attitude to reading comprehension (Olugeko, 2018). Verbal ability is related to language which is related to MWPs .Interpretation of MWPs requires reading comprehension which is related to verbal ability. Although there has been much research in the use of verbal ability predicting academic performance, extant literature available to the researcher showed that it has not been used in the area of MWPs .

Consequently, teachers need to create a suitable environment and employ strategies that encourage cooperative learning and motivate students to challenge one another. Available evidence from the literature as indicated that GIS and NHS have been used to teach other subjects and some aspect of mathematics but are yet to be used to teach MWPs especially in Nigeria. As a result of this, the researcher determined the effects of the two strategies (GIS and NHS), Verbal ability and gender on senior secondary school learning out comes in MWPs in Oyo state, Nigeria.

1.2 Statement of the Problem

Over the years, Mathematics educators have directed their energy to improving students LO in mathematics at various levels of education. This has motivated several researchers to develop innovative teaching strategies that would reverse students' poor performance in Mathematics which is currently at alarming rate. Besides, available evidence shows that inability of students to solve MWPs contributes to persistent decline in students' performance in Mathematics.

Effort to address the inability of students in solving MWPs has culminated into various researches by Mathematics educators such as Personalisation of instruction, mastery learning, problem solving and so on. Majority of these researches focused on

individualisation of instruction. Despite the efficacy of the strategies on students' LO as reported by various authors, the problem of declining achievement, poor interpretation of expression into mathematical statement and negative attitude of students to MWPs still persist. None of either strategy incorporates strategies such as GIS and NHS into the learning and teaching of MWPs .The incorporation of GIS and number - heads - together are assumed to improve the teaching and learning of MWPs. It is also assumed to enable the students to grasp and understand the relevant knowledge, skills and display of positive Attitude to MWPs.

Extant literature have indicated that most studies on GIS and NHS which have the potentials to enhance students' critical thinking and self-confidence in solving Mathematical problems focused on many aspects of mathematics neglecting MWPs. Research findings have consistently shown that MWPs is perceived difficult despite its significance in the school mathematics curriculum. As a result of this, the impacts of the strategies (GIS and NHS) on LO (Achievement and attitude) in MWPs was examined by the study. In addition, the moderator effects of verbal ability and gender on students' academic achievements in and attitudes to MWPs were determined.

1.3 Aim and Objectives of the study

The study aims to investigate the effects of GIS and NHS learning strategies on the achievement in and attitude towards MWPs of senior secondary school students in Oyo North Senatorial District, Nigeria. Also, this research investigates the moderating effects of gender and verbal ability on the achievement in and attitude towards MWPs of senior secondary school students.

The specific objectives of the study are:

1. Investigate G1S and NHS as determinants of achievement in and attitude to MWPs of students by incorporating the moderating effects of verbal ability and gender.
2. Examine the use of G1S and NHS strategies in exposing students to effective strategies of Mathematics word problems.
3. Ascertain if there is improvement in students' LO to MWPs.

1.4 Research Question: What is the level of students' verbal ability in mathematics word problems?

1.5 Hypotheses

Based on the stated problem, the following null hypotheses were tested at 0.05level of significance.

H_{O1}: There is no significant main effect of treatment on students' (a) achievement in MWPs

(b) Attitude to MWPs

Ho_2: There is no significant main effect of gender on students' (a) achievement in MWPs

(b) Attitude to MWPs

Ho_3: There is no significant main effect of verbal ability on students' (a) Achievement in MWPs.

(b) Attitude to MWPs.

Ho_4: There is no significant interaction effect of gender and verbal ability on students'

(a) Achievement in MWPs (b) Attitude to MWPs

Ho_5: There is no significant interaction effect of treatment and gender on students' (a) achievement in MWPs (b) Attitude to MWPs

Ho_6: There is no significant interaction effect of treatment and verbal ability on students' (a) achievement in MWPs. (b) Attitude to MWPs.

Ho_7: There is no significant interaction effect of treatment, gender and verbal ability on students' (a) achievement in MWPs (b) Attitude to MWPs.

1.6 Significance of the Study

The findings of this research would improve students' abilities to solve word problems in Mathematics. The study would improve student's attitude to solve MWPs. The students' skills for solving MWPs would likely be enhanced by the study. Also, the study would likely be beneficial to mathematics teachers by exposing them to active strategies such as GIS and NHS for teaching MWPs.

Findings would probably be of help to curriculum planners to include innovative and formidable strategies such as GIS and NHS in the curriculum that will improve the learning and teaching of MWPs

Findings would also likely inform the serving and pre-service teachers the need to adopt the GIS and NHS strategies as alternative to the conventional strategy to teach word problems in Mathematics.

In a bid to actualise this objective, the recommendations and outcome would be presented to relevant stake holders by seminars and conferences.

1.7 Scope of the Study

This study covered senior secondary school two mathematics students drawn from nine senior secondary schools in Iseyin, Itesiwaju and Kajola Local Government Areas of Oyo North Senatorial District. It looked at how students' achievement and attitude in solving word problems in mathematics were affected by two types of learning strategies—GIS and NHS. Additionally, it investigated the moderator effects of verbal ability and gender on students' word problem learning outcomes. The contents that are amenable to MWPs were chosen. These includes: (a) Arithmetic word problems (b) Algebraic word problems.

1.8 Operational Definition of Terms

The terms used in this research are operationally defined as follows:

Learning outcomes: These comprise students' scores obtained from (a) MWPs achievement test and (b) students' Attitude to MWPs questionnaire.

Learning strategies: These are plans, skills, techniques used by a teacher to facilitate understanding of a unit of instruction by the students.

Cooperative learning strategies: It is a strategy of learning that comprises small groups of students that possess diverse level of ability using different learning activities to facilitate their comprehension of the content.

Group Investigation Strategy (GIS) : It is a classroom organisation where small groups of students work cooperatively using inquiry, cooperative planning, projects and group discussion.

Numbered-Head-Together Strategy (NHS): It is a strategy where learners are numbered and grouped so as to execute a task. The students engage all their efforts and skills to execute specific learning goals.

Conventional strategy: It is a teacher centered method of teaching in which the teacher teaches with prepared note of lesson.

Mathematics Word Problems: This refers to algebraic and arithmetic exercises that present relevant information on a problem as a text, rather than in the form of mathematical notation.

Verbal ability: This refers to the capability of learners to comprehend and communicate effectively with words measured by verbal ability scale.

Achievement in MWPs: This refers to the pre-test and post- test scores obtained by students on the Mathematics Achievement Test in word problems.

Attitude towards MWPs: This refers to the students' feelings as regards MWPs measured by MWPs Attitude Scale.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviewed related conceptual, theoretical, and empirical literature under the following sub-headings.

2.1 Theoretical Framework

2.1.1 Social Development Theory of Vygostky

Social Development theory was propounded by Russian clinician lev Vygotsky (1896-1934). His work was generally obscure toward the west until it was distributed in 1962. His theory is one of the ground works of constructivism. Vygotsky worked effectively in the area of brain science creating numerous compelling text including thought and language generally recognizable among his text written in Russia in 1937 and meant English in 1962. Vygotsky put together his learning theory with respect to collaboration expressing that working with a more experienced individual is relevant to improvement. Mental cycles are the outcome of social and social collaborations (Vygotsky, 1978; p84).

The more proficient request, the area of proximal change, and social cooperation are two of its most important assertions. Vygotsky believed that social learning precedes improvement. During the mental turn of events, social collaboration plays a significant role. He declares, " There are two instances of each social development ability: first on a group and then on an individual level. This is applicable to intentional consideration, coherent memory, and the arrangement of ideas as well.To begin between individuals (Entomb mental) and then within the child (intra psychological.

Real relationships between people are the foundation for all of the greater abilities. The term "the more knowledgeable other" (MKO) refers to anyone with a higher level of understanding or ability than the student for a particular task, cycle, or concept. The MKO is typically regarded as a teacher, mentor, or more senior adult, but they could also be peers, a younger person, or even PCs. The Zone of Proximal

Development (ZPD) is the distance between students' ability to perform a task under adult, guidance and or peer collaboration and students' ability in solving the problem independently. According to Vygotsky, learning occurred in this zone. The distance that separates students capacity to deal with a problem on their own from their ability to do so with guidance, possibly from peers, is known as the zone of proximal turn of events (ZPD).

Vygotsky concentrated on the relationships that exist between individuals and the social environment in which they interact and connect in shared encounters. Vygotsky argues that in order to intervene in their social environments, individuals employ culturally created instruments like writing and discourse, for instance. Children initially acquire these devices solely as friendly means of conveying their needs. Vygotsky agrees that using these devices helped people think more clearly.

The ramifications of this theory are that group work benefits students socially, genuinely and intellectually. Through experience students can master auxiliary abilities like blend, thinking and designation. Students can take proprietorship of the errand as well as their learning. Agreeable work permits educators to go to less-capable or powerless students in the group which is troublesome in enormous class. Educators need to establish a learning climate where students interface with each other to find things without anyone else. The job of the educator ought to move from information transmitter to an information facilitator. The theory is pertinent with this research as it laid accentuation on coordinated effort among the students and furthermore the instructor so the growing experience turns into a proportional encounter. GIS and number-heads-together procedures are in accordance with this theory on the grounds that the two methods give an open door to the students to be a functioning member in the learning setting.

2.1.2 Social Interdependence Theory

Social interdependence theory is a subsidiary of gestalt school of brain science (Kurt Lewin, 1935) and theory of collaboration and contest (Deutsch, 1949).Social reliance exists when the achievement of one's objectives is impacted by the activities of others (Deutsch, 1949). Social relationship theory was subsequently evolved by David

Johnson and Roger Johnson in 1970. Social relationship is the vital component of helpful learning. It is of the reason that relationship organizing decides how people communicate and the collaboration design decides the results of circumstance (Deutsch 1949a, 1962, Johnson, 1970 2003, Johnson and Johnson 1974, 1989, 2005). Social reliance theory laid accentuation on three objectives structures. Positive relationship (agreeable), Negative reliance (cutthroat), and nonappearance of association (no relationship).

Positive reliance happens where every individual objective situated exertion adds to other objective achievement. It results to collaboration where students cooperate to accomplish a shared objective. The students rely upon one another for direction, upholds, data assets and so on. Students 'gifts supplement each other inside the group so the group work really to help each other through common assistance, compelling correspondence, valuable administration of contention to finish a job, accomplish or deliver in other to arrive at the group objectives, positive reliance produces numerous mental cycles specifically substutability, inducibility and positive cathesis. Substutability is the degree by which the activity of one individual substitutes for the activity of someone else. Inducibility can be depicted as the receptiveness to impacting others by being affected while positive cathesis is the venture of positive mental energy in objects beyond oneself (Deutsch 1942a 1962). These cycles make sense of how new thought processes and objectives are made and the way that personal circumstance are extended to become joint interest in helpful circumstances.

Negative interdependence happens where every individual's objective situated exertion blocks the accomplishment of each other to arrive at their objectives. This is finished through deluding or ineffectual communication, distrust and endeavoring to win conflicts. Non substutability and negative cathesis are the results of mental cycles made by bad reliance. Non substutability is the degree by which the activities of one individual don't fill in for the activity of someone else. Negative cathesis is the speculation of negative mental energy in objects beyond oneself and the protection from being affected by others. Nonattendance of relationship happens where people work reliantly without connection with each other. Each part works freely to expand their own efficiency and accomplishment of others as unimportant.

The ramifications of this theory to the study is that an instructor needs to advance a learning setting by which the students will understand that the most effective way to succeed is to team up with their companions and consider each understudy significant. In the event that an understudy neglects to contribute, the group cannot really accomplish their shared objective and as such it is possibly they do or die together. The theory is pertinent to this research since it stresses the corresponding jobs of the students in the educational experience. GIS and Numbered Heads-Together systems are in line this theory as the two methods elevate student communications to help, guide, and give data and assets so students show responsibility for learning.

2.2 Conceptual Review

2.2.1 Academic achievement

Scholastic accomplishment assumes an unmistakable part in an instructive cycle. A result normally an exhibition shows the degree of achievement of a particular objective of an informative setting like schools, schools and College. It can likewise be considered as the phases of tutoring one has achieved effectively in their examinations. Bernath and Paul (2016) observed that academic achievement is the extent to which a student, Teacher or Institution has achieved their short or long term educational goals. Many elements impact scholastic accomplishment of a kid. These include: financial variables, school initiative, understudy factors, private mentoring instructor factor, among others. Financial variables are key in the scholarly accomplishment of students. Review have shown that financial status majorly affects students 'accomplishment (Mirowsky 2017; Benner, Boyle and Sadler 2016). School authority is another conspicuous variable that can impact students 'scholarly accomplishment. School authority can decidedly affect school execution and students 'learning accomplishment (Allen, Grigsby, and Peters, 2015; Hitt and Exhaust, 2016; Beare, Caldwell and Millikan, 2018) it was found that school Head can improved students' accomplishment in numerous ways, for example, association of guardians and different partners in navigation and arrangement of helpful air and environment (Supovitz, Sirinides and May, 2009) which will majorly affect students 'accomplishment Another component that influence students’ scholarly accomplishment is the students' variable.

The review propensity, using time effectively and imagination of the students have the potential in impacting their scholarly accomplishment. Han, Capraro and Capraro (2015) and Keinonen (2018) saw that students 'self-inspiration, using time productively, commitment, conduct and mentalities are the unmistakable elements that decide their scholastic achievement. One more component that assumes a noticeable part in the scholastic accomplishment of students is private coaching. It works in accordance with the school. It supplements the school endeavors. Private coaching sets out a freedom for students to perform better in school and to remain in the school system for extended periods of time (Bawl, 2010).

Instructor factor is likewise another unmistakable variable that can blemish or make students 'scholarly accomplishment. An instructor can influence students 'accomplishment by being a facilitator, an educational pioneer, a model and a tutor. There are plenty of observational proof that uncovered positive connection between's instructor component and students 'accomplishments. For instance, Adnot, Dee, Katz, Wyckoff and Katz (2016) and Vizeshfar and Torabizadeh (2018) saw that a productive and powerful instructor can impact students' instructive accomplishment and monetary results). The technique involved by an educator in the learning setting is likewise significant. Research has shown that students educated with helpful learning will generally display higher scholastic accomplishment, more profound comprehension of learned material, more prominent capacity to see circumstances according to others viewpoints, more uplifting outlooks towards contents regions and more noteworthy confidence (Simsek, 2013; Tran and Lewis, 2012; Vanwyk, 2012). Students 'scholarly accomplishment in science has been a ton of worries among educators, guardians and different partners in Mathematics schooling.

2.2.2 Attitude

Demeanor is a bunch of inclinations including convictions, manners and sentiments towards an item, individual, a group or even a theoretical thought. It is a settled perspective or feeling about something mental and profound substance that described an individual. A speculative build depicts an individual's level of liking or disdain for an item, individual, or a spot. It is a general positive or negative impression of

a thing. Disposition has three fundamental parts which are: Influence (feeling), Conduct (Activity) and Perception (Mindfulness). It is an assessment of an article which might be communicated as like or abhorrence, star or hostile to, great or ominous and good or pessimistic. Now and again, we might have mix of positive and negative mentality towards a similar item called irresolute disposition. Disposition will in general endure for long time and across circumstances. Anyway with new encounters and data, it might change. Mentality guide thinking and conduct despite the fact that it could be affected with outside factors.

The pessimistic mentality towards others brings relational distance and chilly relationship while uplifting perspective makes amicable relationship and carries us nearer to other people. Mentalities not set in stone by the data available to us. Subsequently, it will in general change out of nowhere since knowing all the data accessible about a specific item, spot or things is beyond the realm of possibilities. Demeanor might be implied or unequivocal. Implicit attitude are those that we are conscious of yet impact our way of behaving and conviction. Explicit attitude are those that we are conscious of and further influence our way of behaving and conviction. Disposition gives numerous jobs which include: Inner self protective, esteem articulation, information and utilitarian/instrumental. Self-image cautious aides in working with the projection of inside held clashes onto others. Esteem articulation empowers the projection of personality and what we have faith in. Information assists with distinguishing the world while Utilitarian/instrumental helps with keeping away from discipline and gain rewards.

Many elements impact students' mentality in a learning setting, for example, showing procedures took on by Educators (Oghenevwede, 2019), students' imagination (Cristiana, Raquel and Natalia, 2021), mental (Han and Craftsman, 2014), orientation (Hareesol, Fauzee, Othman and Khairi, 2016). The students' mentalities impact their exhibitions in different subjects especially science. Many exploration discoveries have connected students' exhibitions to their perspectives. For instance, Mazana, Montero, and Casmir (2019) found significant positive correlation between students’ attitude and performance in mathematics. Students' perspectives towards math and science impact their scholarly accomplishment and choices to proceed with these subjects (Wang and Degol, 2013). Disposition of students in math affects their learning results in math

(Amatobi and Amatobi, 2020). Also, a few students will in general have negative mentalities towards learning math. Ntibi and Edoho (2017) and Sulaiman, Rameli, and Ado (2020) observed that majority of the students that majority of students have a propensity of negative demeanor towards learning science. Most students at rudimentary levels have a negative mentality towards learning science since they believe is an exercise in futility (Chaudary, Malik and Rafiq, 2019). Students with uplifting perspectives will quite often performed better compared to students with negative mentalities in science.

2.2.3 The Mathematics Word Problems (MWPs)

A Mathematics Word Problems is a mathematical issue written in any normal language like English in light of any subject space. MWPs is a numerical activity where significant back ground data on the issue is introduced as text rather than numerical documentation. It is a numerical practice as speculative inquiry that needs numerical examination and condition to be settled. As per Pfannenstiel, Bryant and Porterfield (2015), MWPs are blend of numbers and words in which students apply numerical guidance in the context of problem solving.

Mathematics Word Problems fills many needs in numerical schooling. This incorporates rehearsing of fundamental numerical activities and readiness of students to apply numerical abilities outside the study hall.MWPs is intended to assist understudy with applying numerical ideas to genuine circumstances. As per Barwell (2011), utilizing MWPs assists youngsters with interfacing reality to science. MWPs are viewed as the essential part in math educational program as it fosters students' legitimate examination, help their imagination and improves their psychological abilities. Thus, MWPs is one of the spaces typically evaluated by a few global tests, for example, PISA-programing for worldwide students Evaluation and TIMSS-Trends in mathematics and science study.

Notwithstanding the importance of MWPs to students, it is normally the most troublesome part of science for students (Verschaffel, Stanislaw and Van Dooren, 2020), solving MWPs is among the principal hardships in polynomial math for some optional school students everywhere (Hedge and Karp, 2013). Mathematics Word Problems are as yet thought to be trying for students when contrasted with different sorts of issue in

arithmetic (Fatmanissa and Kusnandi, 2017) Sepeng and Madzorera (2014), investigated sources of difficulty in comprehending and solving of Mathematics Word Problems. Examination of the information showed that students battled with meaning of mathematical terms utilized in the MWPs explanation and educational jargon. The concentrate likewise showed that numerical language impact student's appreciation in tackling Mathematics Word Problems. Many variables add to students' promise issue execution, for instance, individual contrasts and social elements (Daroczy, Wolsika, Meurers and Nuerk, 2015), semantic and mathematical elements (Daroczy et al, 2015), powerlessness to appreciate and deciphered the sentences to continue to the cycle and encoding abilities (Adu, Assuuah and Assiedu-Addo, 2015), failure to recognize immaterial data characterizing vocabularies examining extended sentences and grasping composed setting (Gafoor and Sarabi, 2015; Seifi Hagverdi and Azizmohamadi, 2012), authentic blunder or mistake in understanding what was really given in the message (Agustiawan, Uno and Ismail, 2013) among others.

Effective word critical thinking contains representation of the issue (Dela-Cruz and Lapinid, 2014), issue interpretation (Dela-cruz and Lapind, 2014), understanding abilities (Pearce, Brunn, Skinner and Lopez, 2013) acknowledgment of MWPs type and appropriate solution to solve problem (Powell, 2011), Recognizable proof of applicable data from unessential data (Swanson, 2014).

2.2.4 Strategies of Teaching Word Problems

Homeroom practices and procedures utilized by the educators assumed a critical part in upgrading students' critical ability to think. Students should have the option to perceive kinds of MWPs and the proper answer for tackle the issue (Powell, 2011). The objective is to train students a methodology to assist them with becoming effective students. For instance, mental methodology can be utilized to help youthful students with numerical hardships to upgrade learning and work on their exhibition (Powell, 2011). A mental system assists students with zeroing in on the issue. Construction and increment the capacity to figure out the issue, (Pfannenstiel, Bryant and Porterfield, 2015).

One more imposing procedure that can be utilized by the educator in showing group is Meta mental methodology. It guides students to comprehend and be mindful of

the prerequisites. Meta mental techniques assist students with arranging, screen and change their methodology in taking care of MWPs (Pfannenstiel, Bryant, Bryant and Porterfield. It expounds six part of word critical thinking as follows: Expressing the inquiry, distinguish the significant units and numbers, examine the inquiry, select the activity expected to settle, come up with a technique to tackle lastly eliminate any irrelevant data (Pfannenstiel, 2015). Three principal steps are adjusted out of these six parts. In the first place, to peruse the issue, circle significant words and numbers and afterward cross out the pointless data. The subsequent step is to plan and draw graph or a guide, put the condition into composing and track down an answer for the issue.

The final step is to check the answer. Cognitive and Meta mental technique increase students' comprehension of Mathematics word problems. Educators need to lay accentuation on these strategies steps to their students by engaging all learners in an intuitive cycle. As per Swanson (2014), youngsters should be coordinated to think about significant data inside the setting of expanding unessential data. Understudy requirements to follow numerous moves toward tackling the issue. They ought to get familiar with the expertise to peruse the subtext and grasp the given data, mathematize the issue by composing a point by point plan, make numerical associations, break down and afterward check.

Dixon et al, (2014) state that students will foster profound logical comprehension of Mathematics word problems when their educators give them rich and significant learning exercises. For instance, on the off chance that students are requests to compose Mathematics word problems to an occasion in their lives, for example, a football match-up, an excursion, etc. Students can make their own MWPs and emphatically impacted their comprehension and attitude towards math.

Solid shapes methodology is one more system that can be utilized to handle intense Mathematics word problems (Connel, 2017). Solid shapes mean circle, underline, box, wipe out, assess and tackle issue. It empowers the students to recognize the vital part of the issue. Solid shapes methodology dials back higher capacity which at times hurry through their work without continuously validating accuracy consequently lead to a decrease by students (Connell, 2017).

Pattern based guidance is one more system that trains students to zero in on the hidden design of Mathematics word problems. It further develops learning for students at all levels. Pattern based guidance helps students classify and coordinate issue into various sorts and recognize techniques in light of fundamental numerical comparability (Jitendra, 2017). Through mapping based guidance, students are assisted with zeroing in on the hidden issue structure and address issue text utilizing visual schematic charts that show how amounts are moved. With construction based guidance, students distinguish the kind of issue (Proportion, extent, rate, etc) and the important data expected to take care of the issue, schematic charts are utilized to picture how amounts are connected.

Composition guidance involves distinguishing Mathematics word problems types, address them accurately and involving powerful technique for tackling them. It has been viewed as successful among students with numerical troubles and inabilities (Jitendera et al, 2016). There are two primary sorts of patterns added substance and multiplicative. Added substance blueprints can be utilized for option and deduction issue which is viable in Primary school. Multiplicative patterns can be utilized to take care of augmentation and division issue. They are of three sorts. Equivalent, Correlation and Proportion.

Construction can be characterized as memory structure for putting together item and strategy into an edge work which can be filled in with explicit circumstance. The basic reason of SBI is that all new data interfaces with inner information possessed by the individual. SBI expects that students Recognize Mathematics word problems types before tackling of the Mathematics word problems. SBI depends on express helping students to perceive the basic designs of Mathematics word problems in this way finding designs that consider comparative arrangement.

2.2.5 History of Cooperative Learning

Cooperative learning has been well-informed into. It gives off an impression of being the most grounded experimental exploration base of any instructive advancement and there are parcel of proof proving the utilization of helpful learning than there is for some other part of instruction (Kagan and Kagan 2009). Agreeable learning can be utilized to show many subjects at any instructive level from kindergarten to College (Hornby, 2009; Johnson, Johnson and Smith, 2007). Helpful learning has been utilized

for a really long time. What might be compared to the adage "Two great heads are superior to one" can be found in essentially all societies. Helpful learning history is traced all the way back to eighteen century when Andrew Chime and Joseph Lancaster utilized and engendered it in Britain. It was acquainted with U.S in 1806.

In the mid nineteenth 100 years, the reception of helpful learning in the homeroom setting was maintain to cause the instructive objectives around then like Americanisation of a different understudy body and viability in showing a class including blended grades. Colonel Francis Parker was among the noticeable defenders of Agreeable learning in the late nineteen 100 years. His acclaim and achievement began in his idea of connections between helpful learning and majority rule schooling. His energy finished the reception of agreeable learning in government funded schools and spread of co-employable learning viewpoints and functional methods. His technique for organizing agreeable learning affected American school system for century. In the mid-20th 100 years, John Dewey (1924) fostered parker's association between agreeable learning and a vote based system and expanded the utilization of helpful learning in his undertaking technique for guidance at school. Dewey thought that structure up a majority rules government and helpful setting at school is essential for people to be helpful and carry on with justly, all things considered.

In 1930 to the mid-1960, serious and individual learning was promoted because of accentuation on relational rivalries. Agreeable learning advocates didn't lose their certainty and interest in the job of collaboration in training. During this period Kurt Lewin (1935, 1948) and Morton Deutsch (1949) further fostered their perspectives on the group as a powerful entire and figured out a hypothesis of collaboration and contest. In the late I960, based on Deutsch's viewpoints, David Johnson and his sibling Roger Johnson (Johnson et al, 1994) laid out friendly relationship hypothesis, began educator preparing programs on helpful learning and laid out the agreeable learning place at the College of Minnesota. Helpful recaptured strength in the 1970 as a significant powerful school practice for furnishing students of various ethnic group with valuable open doors for non-shallow agreeable connections (Slavin, 1995) from that point forward, some striking agreeable learning scientists (Elliot 30).

Aronson, Lynda Baloche, Elizabeth Cohen, Robyn Gillies, George Jacobs, David Johnson, Roger Johnson, Spenser Kagan, Shlomo Sharan, Yeal Sharan, Robert Slavin) have participated in investigating explicit utilizations of helpful figuring out how to study hall showing which finished various strategies and models. In 1979, the global Relationship for the investigation of collaboration in Training (IASCE) was laid out in the, still up in the air to offer help for agreeable learning professionals and spreading of advance examination on helpful learning. Its yearly meetings have filled in as significant events for spreading thoughts and encounters among agreeable learning teachers around the world.

2.2.6 Group Investigation Strategies (GIS)

GIS is a group based navigation and majority rule processes. It requires understudy having great capacity to convey and group handling abilities. Instructor plays a working with job by assisting students with arranging, carry out and sort out group processes. The educator additionally fills in as scholarly advisor. GIS further develops understudy decisive reasoning (Chairunnisa, 2016, Mellia and Disman, 2016). GIS contains four significant parts (the four I's) which incorporate Investigation, cooperation, Translation and Characteristic inspiration. Investigation suggests that the groups center around request about the picked point. Connection alludes to the method involved with investigating thoughts and helps each other to learn. Translation happens when the group orchestrates and expounds on the discoveries of every part to improve lucidity and comprehension of thoughts. Characteristic inspiration includes conceding students' independence during the investigation cycle. GIS continues in six stages: first, the educator gives a diverse issue to the class and students pick a subtopic to concentrate on in view of their decision or instructor’s decision. Second, the group plans their investigation. The strategy, assignment and objectives must be as per the subtopic picked. Third, the groups set out on the request. Fourth the group plans their show. They surveyed what they have realized and orchestrate it into structures that can be effectively understood by the class. Fifth, groups lead the show at long last, the students and instructor's assess the investigation and collectively. GIS advances helpful perspectives and conduct among peers (Sharan, 2010).

2.2.7 Numbers-Head-Together Strategy (NHS)

Spencer Kagan developed the CL strategy of Numbers-Head-Together. It includes incorporation of students to survey the illustration covered and check how they might interpret example content through numbering, addressing, heads together and replying. NHS holds each student accountable for learning the materials. By having students work together in groups. The teacher asks a question and the students work together to answer it. They are divided into groups and each person gives a number (from one to the maximum number in each group). The teacher poses a question and students put their heads together to figure out answer. The strategy ensures that each student knows the answer to the teacher's problem or questions by having them work together in groups. All team members are very interested because no one knows the phone number the teacher will eventually call. Members of the NHS are socially and intellectually active, so the NHS encourages interdependence because they can help each other find the right answer and explain it to each other. Additionally, individual accountability was emphasized because each member must be prepared to represent the team. Since each member has the opportunity to respond to the question, the NHS ensures that everyone participates equally. It likewise improves synchronous communication since every one of the individuals set out to really concentrate to proffer answer for the inquiry. NHS help students learn in a fun, dynamic, and creative way that is easy to understand. It expands rivalry and participation among students.

NHS provides opportunities for practice, rehearsal, and content material discussion. The method can be utilized at any stage of the educational process, including elementary (Wahyudin, 2017), junior high (Muryanti, 2016), and senior high (Nuryamisi 2016, Alifiani, 2017).

2.2.8 Conventional Method

Traditional procedure is a technique overwhelmed by the educator that is generally found in schools around the world. It has the ability to quickly present information. Students who learn best by listening will enjoy it. According to Akinsola (2011), conventional strategy is centered on the teacher and leaves the students to be

passive and uninvolved in the class. According to Aremu (2010), this teaching method lacks interaction and may not accomplish the lesson's goals.

Ukwuru (2011) says that the learner's attitude, the teacher's attitude, instructional aids, and the curriculum's instructional methods are largely to blame for students' low SSCE scores. According to Owusu, Monney, Appiah, and Willmot (2010), conventional strategies tend to be more successful for high achievers than for low achievers. Moreover, Sam, Owusu and Krueger (2018) analysed the adequacy of 3E, 5E, learning cycle and the traditional methodology in showing science illustration. The study's findings showed that the experimental and control groups performed better. Likewise the outcome showed that learning cycle approach was more powerful in showing the organic ideas than customary methodology.

2.2.9 Verbal Ability in Learning

A person's verbal ability is their capacity to communicate their thoughts orally or in writing. It is the students' capacity for word organisation in a coherent manner. Typically, verbal ability is defined as the capacity to write and speak clearly. A learner's language proficiency is influenced by their innate ability. Verbal ability includes both the capacity to select the appropriate words that are meaningful to the audience and the vocabulary. It is an estimation of language capacity, semantic thinking and critical ability to think of an individual. Cognitive ability to use and comprehend language is related to verbal ability. Language proficiency, oral communication, verbal memory, verbal reasoning, writing skills, grammar and written communication are just a few of its many components. According to some studies, good verbal ability is needed to interpret any text materials. For instance, good verbal ability helps students understand the materials, interpret complex questions, and draw conclusions (Daniyati and Sugiman, 2015). Additionally, Ijiga, 2014, Gambari, Kutigi, and Fagbemi, 2014, state that any students' interaction with and discussion of text materials required a relatively high verbal ability. In addition, James and Adewale (2012) discovered that students with high verbal ability are better able to comprehend the problem's purpose, analyze it, and write down their responses.

LO are strongly influenced by verbal ability. In 2019, Kim, Linda, and Lombardino looked at how students' learning was affected by their cognitive differences and presentation styles. Regardless of the instructional medium, the findings indicate that verbal ability was a strong predictor of learning outcomes. Egbugara (2018) looked into how verbal ability affected how people used an advance organiser in physics. The outcome demonstrated that higher physics achievement may be linked to improved verbal ability. Okoh, Okro and offorma (2019) analyzed the effects of various educational media on accomplishment of senior optional school students in oral English in Stream State, Nigeria. The outcome showed that high verbal capacity students accomplished higher than low verbal capacity students.

2.2.10 Gender Concept in Learning

A set of traits that distinguish men from women, particularly men, is known as gender. Sex and social roles are just a few of the characteristics. Distinctions in sexual orientation in math accomplishment and capacity has stayed a wellspring of worries as researcher try to address the under portrayal of ladies of the greatest degrees of math, actual sciences and designing (Asante, 2010).

Young ladies of a comparative capacity were viewed as both more under positive about their self-conviction and report lower levels of aim to concentrate on math into A level or past than their male companions (Sheldrake, Mujtaba and Reiss, 2015), Smith, (2014). Gender disparities in mathematics, particularly at average attainment levels, have generally evened out, decreased, and in some cases reversed, both nationally and internationally. As per association for financial collaboration and Advancement (OECD, 2013), young ladies failed to meet expectations young men in 37 out 65 nations. According to Ganey et al. (2013) and the OECD (2013), most able girls performed below most able boys.

Gender differences in various cognitive motivational variables (locus of control, academic self-concept, and use of learning strategies) were investigated by Dabbagh and Milad in relation to performance in school subjects like literature and mathematics. The results indicate that there are differences between the sexes regarding the variables that were taken into consideration. Girls have a greater internal locus of control, utilise

strategies for attitude, motivation, time management, and anxiety, and self-test more frequently than boys. While boys improve their math scores and employ concentration, information processing, and main idea selection strategies more frequently, girls have a greater internal locus of control. External locus of control, academic self-concept, study aids, and test strategies did not differ by gender. Boys and girls have different cognitive motivational functions in the classroom, with girls taking a more flexible approach to learning tasks.

2.3 Empirical Review

2.3.1 GIS and Student's Achievement in MWPs.

There are plenty of review which examined the impact of gathering examination and students' scholarly accomplishment in schools. One of them is Ebele and Abubakr's (2019) investigation of the effects of GIS on the academic and biological achievement of secondary school students in Kwali, Education Zone, ECT Abuja. The study came to the conclusion that, in terms of mean achievement scores, the experimental group performed better than the control group. Astiti (2018) examined the difference in student Physics LO (PLO) between a jigsaw learning model and a GIS learning model with brainstorming technique. The results of learning in the cognitive domain are the subject's learning outcomes. According to the findings, the Jigsaw learning model with brainstorming technique had a lower percentage of students (PLO) than the GIS learning model with brain storming technique.

Sangadji (2016) dealt with utilization of gathering examination learning model in further developing learning accomplishment of professional school students in Indonesia. The findings demonstrated that the GIS learning model was properly implemented and that vocational students perform better academically. Ogundinwin, Asaaju, Adegoke, and Ojo (2015) investigated the impact of laboratory GIS strategies on biology achievement. Bunch examination procedure was viewed as fundamentally not quite the same as the customary technique in their accomplishment scores. The researchers came to the conclusion that the strategies positively impacted students' biology achievement. In Kogi State, Nigeria, Adejoh (2015) investigated the effects of GIS and jigsaw instruction on student achievement and transferability in economics. The study found that the jigsaw

method of teaching Economics has a greater impact on students' achievement and transferability than the group method, but the difference was not significant. It additionally showed that male understudy accomplishment and adaptability scores were higher than the female partners when educated with these two educational procedures.

The thing that matters was likewise not huge. The scientist, at long last suggested that financial matters educator ought to embrace jigsaw educational method and gathering examination educational procedure to work with instructing and learning and in this way works on understudy's presentation in the subject. Along these lines, Pitoyo et al, (2014) chipped away at the impact of gathering examination learning model, speed up learning group and pretending on primary school students composing abilities saw from mental style. The result demonstrated that agreeable learning model of gathering learning is superior to any of speed up learning and pretending. In the group of students who have the dependence cognitive style, the accelerated learning team produces the same outcome as the role-playing type.

The researchers came to the conclusion that each of the three kinds of cooperative learning was just fine. Likewise, Samuel (2018) found huge contrasts in the mean accomplishment and maintenance scores of students showed utilising Jigsaw iv, Gathering examination, switched Jigsaw agreeable educational procedures and the customary exhibition strategy for the three helpful educational methodologies.

Abdul Gani, Asyik, and Zaiyana (2016) conducted research on their own to investigate the impact of the GIS method on the process of teaching reading comprehension to second-grade students at a private high school in Pidiejaya, Indonesia. According to the findings, students who were taught reading using the GIS technique performed better than students who were taught reading using the standard individual reading activity method. It was prescribed to English educators to apply the gathering examination procedure in educating perusing. Suradi, Widya, Patta, and Muh Jufri (2018) looked at how the GIS learning model improved elementary school students' critical thinking skills. The outcome showed that the gathering examination model affects decisive reasoning of students' capacity. Teachers should use GIS as an alternative teaching model to practice critical thinking and assess students' abilities, according to the researchers. G1S and mathematics achievement were examined by Indart, Mardiyana,

and Pramudya (2018). The discoveries of the review uncovered that bunch examination learning model delivers preferable arithmetic learning accomplishment over learning with ordinary model on material of quadrilateral. The entries above loan trustworthiness to the way that bunch examination is a considerable methodology in essentially all features of learning.

2.3.2 GIS and Students Attitude to MWPs.

In their 2018 study, Santyasa, Sukra, Warpaja, and Komang Surdarma investigated the impact of the GIS model on students' critical thinking, attitude, and character while they were studying physics in senior high school. The findings demonstrated that, when it came to helping students learn physics in senior high schools, the GIS model performed superiorly to direct instruction in terms of developing critical thinking abilities, social and spiritual attitudes, and character. Yuandini and Sahyar (2017) conducted research on the effects of the cooperative learning model of GIS assisted flash media. They found that learners' conceptual knowledge improved when the cooperative learning model of GIS assisted flash media was used rather than traditional learning. Students with above-average scientific attitudes have better conceptual knowledge than those with below-average scientific attitudes. Students' conceptual knowledge was influenced by the cooperative learning model of GIS supported by flash media and the scientific attitude. This interaction demonstrated that a group of students with an above-average scientific attitude benefited most from flash media because of their superior conceptual knowledge.

Muhammed (2018) investigated how the type of GIS affected students' self-confidence and ability to solve mathematical problems at SMP negeri 2 Rembang 2 state Junior High School during the 2017/2018 school year. Students in Junior High School 2 Rembang's confidence and problem-solving abilities were found to be impacted by the GIS learning model. Kusmaryono, Suyitono and Dwidayati, (2018) examined bunch examination based learning in working on students' useful attitude and numerical power. The findings demonstrated that the GIS approach to learning mathematics was successful in transforming students' negative attitudes toward mathematics into productive (positive)

attitudes and had increased their mathematical power. Iswardati (2016) implemented a GIS into the speaking abilities of SMA 2 Samarinda, Indonesia, second-grade students.

The findings showed that the students' speaking motivation skills improved as a result of GIS. Nasrudin and Azizah (2010) used the context-oriented implementation of "GIS cooperative learning" at the acid, base and salt topic in junior high school to examine improvement in thinking skills and scientific attitude. The findings demonstrated that traditional-oriented GIS cooperative learning can enhance students' activities, thinking abilities, and scientific mindset when learning science. Sukmawati (2015) researched the impact of undertaking based learning and helpful learning bunch examination on students' idea dominance, logical mentality and imaginative reasoning ability. The findings showed that students' scientific mindset and creative thinking were influenced by learning models like Problem-Based Learning and GIS. Andriati, Sariyatun and Nunuk (2018) concentrated on the execution of gathering examination with general media learning media in working on students' mentality and accomplishment in learning of affection the country at Middle school students.

The findings demonstrated that students in class V1I1A Sambirejo 2 state junior high school improved their learning achievement and attitude of love for the homeland as a result of using the learning model of GIS with audio visual learning media. Scientific attitudes were examined by Anggita, Citra and Widiana (2018) using cooperative learning models of the investigation group type. The review result showed a tremendous distinction in logical mentalities between classes that were shown by helpful learning model of gathering examination type and classes that were shown by traditional learning model of gathering examination agreeable learning" context oriented situated at corrosive, base and salt point in Middle school. This suggests that students' scientific attitudes were positively impacted by the cooperative learning model of GIS .

2.3.3 Numbered Heads Together Strategy and Student’s Achievement in MWPs

Nasrun (2016) looked into how the NHS model and cooperative learning could help students learn mathematics better. It was decided that the application learning model NHS contributes to better LO for students. Veronika Marta Wora, Ranto Hadisaputro, Ngatou Rohman, Husin Bugis and Suharno Nugroho Agung Pambudi (2017) examined

students improvement through the use of NHS way to deal with essential subjects of professional Secondary school in the city of Indonesia Surakarta, the discoveries of the review uncovered that NHS learning model further develops commitment inside the learning exercises as well as the degree of students accomplishment. Leasa and Corebima (2017) investigated the effect of the Numbered Heads Together approach to basic subjects of vocational high school students who had varying academic abilities. The study's findings demonstrated that students' cognitive achievement varied depending on learning models and general academic ability. Be that as it may, the communication between learning models and scholastic capacity didn't influence the understudy scholarly accomplishment. Using different kinds of cooperative learning methods, it was suggested to teachers to design numerous learning models with greater creativity.

Additionally, schools should foster a more cooperative learning environment to prevent unfair competition among students in the classroom and improve academic performance. Teedja and Teedja (2019) investigated the use of Numbered Heads and a Team Game Tournament to increase seventh-grade students' understanding of passive and active voice construction. The aftereffects of the review showed that the score for the two respondents were very comparable with NHT gathering having 59.07 TGT bunches 58.33. It was also demonstrated that students taught with TGT had majorly different knowledge of active and passive voice construction, with mean differences of 0.005 f) 05 between the two groups. The researcher came to the conclusion that the implementation of NHS and TGT enhances student knowledge of active and passive voice. The questionnaire results also indicated that both teaching strategies are eligible to be used in teaching active and passive voice construction, with the NHS class having 64.83% and the TGT class having 63.34%, both of which can be categorized as "Good."

Naibaho (2019) conducted a similar study to examine the impact of NHS on students' English proficiency. The study's findings demonstrated that using the Numbered Heads strategy together can improve English learning achievement and student activity. In addition, Iqbai, Sahyar, and Sudrajat (2017) investigated the connection between motivation and the various cooperative learning models of NHT Assisted Media Video. The results showed that students' natural science achievement was influenced by the cooperative learning model type NHS assisted video media, that students' motivation was

influenced by their natural science achievement, and that students' natural science achievement was influenced by learning model and motivation interaction. Munawaroh's (2015) study compared the social subject learning achievement of NHS and student Team Achievement Division cooperative learning models. The findings revealed a significant difference between the cooperative learning model of NHS and student Team Achievement Division in the social subject learning achievement of eighth-grade students at SMP Negeri 5 Jonbang.

NHS performed better than student Team Achievement Division. Norzubaidah (2019) dealt with NHS in learning science among optional school students. The results showed that NHS is a good way to learn mathematics.

2.3.4 Number Heads Together and student's attitude to Mathematics word problems

Risnaldi, Usman and Diana (2016) explored the effects of the execution of Number Heads Together method on further developing students' understanding appreciation. The study's findings showed that students' reading comprehension has improved as a result of using the number heads in combination. Additionally, students' enthusiasm for learning English increased, as did their motivation to learn well, their bravery in voicing their opinions while working in groups, and ultimately their learning outcomes.

In Indonesian vocational schools, Listiadi, Sulistyowati, Canda, and Sakti (2019) used the number heads together cooperation model to improve learning quality. The study's findings indicated that number heads work better together, that students enjoyed the learning process, and that they were motivated to work together in the classroom. Raissa and Dewi (2018) looked into how kindergarten students' social skills improved when they worked together to learn numbers. The finding demonstrated that putting number heads together effectively enhanced kindergarten students' social skills in the areas of assertiveness, cooperation, communication, responsibility, self-control, self-involvement, and empathy. Prihastini (2018) looked into how cooperative learning model number heads together improved math students' motivation and LO in SMPN 1 Alian, Kebumen, Indonesia. Students in class VIH D SMPN 1 Alian, Kebumen improved their

motivation and LO in mathematics when the application of number heads was combined. Rekha (2013) worked on reimagining education through cooperative learning on student teachers' academic performance, self-esteem, and attitude toward learning (think pair share, round robin brainstorming, number head together, and jigsaw). The outcome showed that learning of the understudy educators was huge with regards to scholarly accomplishment, self - regard and demeanor. The effect of the cooperative learning model (NHS) on seventh-grade students' social attitudes toward competency was investigated by Suzerli, Alberida, and Yogica (2019). The outcome demonstrated that using the NHS in class VII SMPN 1 padang results in improvements in social attitude competence. Pamungkas (2019) inspected "working on students' perspectives toward math through NHS helpful learning models with logical methodology" The outcome showed that understudy mentalities toward science expanded. Setyani (2017) looked at how students' anxiety affected their speaking skills when they played NHS. The outcome uncovered that NHS can lessen students' nervousness in talking. Awal (2020) looked into how the NHS learning model was used to make it easier for students in class VII public middle school 5 Ternate city to learn about Indonesia's natural resources. The findings showed that the number-heads-together learning model helped students learn more effectively. It was also demonstrated that the NHS model can encourage students to be brave in asking questions, responding to questions, and participating in group discussions and collaboration. Additionally, NHS has the ability to create a fun, creative, and active learning environment.

2.3.5 Verbal ability and student's achievement in MWPs

Adejimi, Nzabalirwa, and Shivoga (2020) investigated the relationship between biology achievement and age, gender, and verbal ability among students. Based on age, gender, and verbal ability, the study found that students' achievement varied majorly. Students with a high verbal ability performed better in Biology than students with a low verbal ability. Olatoye and Aderogba (2011) looked into the role that students' verbal and numerical abilities played in their performance on a variety of aptitude tests. The findings showed that students' performance on general aptitude tests was majorly impacted by

their numerical and verbal abilities. This suggests that students must have strong numerical and verbal skills to perform well on general aptitude tests.

Adegbile and Alabi (2007) investigated the effects of verbal ability on achievement in English-language essay writing. In the state of Osun, it was discovered that senior secondary students' achievement in English essay writing was majorly influenced by verbal ability. Izzaty and Setiawati (2019) looked at how students' verbal ability was affected by their educational level and gender. The outcome revealed the disparity in verbal ability between male and female students. Higher Education Institution (HE1), Vocational Higher School (VHI), Senior High School (SHS), and Junior High School (JHS) had the highest average mean scores in verbal ability from highest to lowest. The verbal ability means score of the female students was higher than that of the male students. LO are strongly influenced by verbal ability. The effects of learners' cognitive differences and presentation styles on learning were investigated by Kim, Linda, and Lombardino (2019). Regardless of the instructional medium, the findings indicated that verbal ability was a strong predictor of learning outcome.

In River State, Nigeria, Okoh, Okwo and Offorma (2019) investigated the effects of instructional media on oral English achievement among students. Additionally, the primary effects of verbal ability and gender on students' Oral English proficiency were investigated. The outcome demonstrated that students with high verbal ability performed better academically than students with low verbal ability. Also, Sophie (2020) discovered that children from families with higher social and economic status had better language skills when they were in nursery school and that these verbal skills helped them do better in school.

A learner's critical thinking may also be influenced by their verbal ability. Irawan claims in (2016) that Students' critical thinking is influenced by verbal proficiency. Using the Susan Loucks Horsely model, Wulandari and Nuryati (2018) investigated the connection between verbal ability and critical thinking skills in science learning of vibration, wave, and sound materials. The outcome showed a connection between verbal capacity and decisive reasoning expertise in science mastering of vibration, wave and sound material with pearson relationship coefficient 0.656. The researcher came to the

conclusion that educators should use a learning model that can improve students' verbal and critical thinking abilities.

In addition, verbal ability has an effect on gender; the majority of studies have shown that females perform better than males in reading, writing, and natural language competencies (Geary, 2010, Stoet and Geary, 2013). Barel and Tzischinsky (2018) analysed sex contrasts in verbal and visual-spatial capacities in youth and adulthood. The results demonstrated a significant disparity in verbal fluency, with females and girls performing better than males and females in the test. The ability to solve linear equations was studied by Median, Nyoman and Arjudin (2021) to see how verbal and numerical skills correlated with one another. The result showed that the ability to solve linear equations was majorly influenced by both verbal and numerical skills.

2.3.6 Verbal Ability and Students attitudes toward MWPs

Okere (2019) examined the learning techniques of students drove conversation, students' mentality and verbal capacity to writing-in-English among optional schools senior students in Owerri. Regarding verbal ability, the outcome indicated that there was no significant difference in students' attitudes toward literature-in-English. Mozuratis, chambers and Daneman, (2016) analysed the verbal capacity and show request connection on perusers disposition development when given two sided contention. The conclusion was that participants with low verbal ability were more persuaded by the most recent set of arguments, whereas participants with high verbal ability formed attitudes independently of presentation order. According to the findings, verbal ability is a significant moderator effect of the presentation order when forming opinions from complex prose. According to the Ego identity process Questionnaire (E1PQ)'s exploration and commitment scales, Bra Verman (2016) examined the connection between verbal ability, identity exploration, and identity commitment. The outcome showed a positive relationship between's verbal capacity and personality investigation.

Olugbeko (2018) looked at how pre-service teachers' performance and attitude toward reading comprehension were predicted by instructional strategies like reciprocal and semantic mapping. Pre-service teachers' performance and attitude toward reading comprehension were also examined in light of the moderator effects of verbal ability and

gender. Pre-service teachers' performance and attitude toward reading comprehension were unaffected by verbal ability. Ezenadu (2012) looked into how students' achievement and attitudes toward English prose literature were affected by literature circles and scaffolding instructional strategies. Students' attitudes toward English prose literature were not majorly impacted by treatment, according to the findings. Students' attitudes toward English prose literature and achievement were unaffected by verbal ability or gender. Additionally, there was no significant interaction effect between verbal ability and treatment on students' achievement or attitude. Moreover there was no critical three different ways connection impact of treatment, verbal capacity, orientation on students' accomplishment and disposition to exposition writing in English.

2.3.7 Gender and student's achievement in MWPs

Over a ten-year period, Awofala (2011) looked into the possibility of gender differences in the mathematics performance of seniors from year three. In the example information, the outcome uncovered an orientation impact that was critical in science execution. Likewise, there were huge contrasts in the arithmetic execution of country male and female students as well as single sex male and females' students, all for male students. Echie and Owo (2019), concentrated on distinctions in sexual orientation in Fundamental Sciences Accomplishment of private junior auxiliary school students in Obio/Akpor Neighborhood Government Area of Waterway State.

The outcome of the review showed that orientation didn't fundamentally impact students' accomplishment in that frame of mind in confidential optional schools. In the Aguata Education zone of Anambra State, Nigeria, Ezenwosu and Nworgu (2013) investigated the impact of gender and peer tutoring on biology achievement. The study's findings showed that students who received peer tutoring in biology performed better than students who received traditional instruction. Additionally, male students performed slightly better than female students. Wordu and Iwok (2018) investigated the effects of gender and the learning environment on mathematics academic achievement in Akwa Ibom State, Nigeria. The result of the review demonstrated a huge contrast among orientation and learning climate on students' scholastic accomplishment in senior optional school science. Irungu, Nyagan, and Mugambi (2019) looked at how gender interactions

affected students' academic performance in public secondary schools in Kenya's Muranga County. The results of a simple regression analysis indicated that students' chemistry academic achievement was unaffected by gender interaction. Gender and interest in integrated science among students in the Obio Akpor Local Government Area of Rivers States were examined by Sopuruchi (2015). According to the study's findings, integrated science students' interest is majorly influenced by gender, but their achievement is not.

Gender and social studies secondary school students' academic performance were examined by Nnamani and Oyibe (2016) in the Abakaliki Urban of Ebonyi State. It was uncovered by the discoveries of the review that mean accomplishment scores of female auxiliary school students were superior to their male partner. Additionally, students of both gender in social studies classes taught by male teachers had higher mean scores than those in social studies classes taught by female teachers. Also, female students performed better compared to the manly students showed social examinations by male educators as well as the other way around. At long last, the review showed that there was a tremendous contrast in the mean accomplishment of optional school students in friendly examinations in light of orientation.

In Italy, Di-Tommaso, Mendolia, and Contimi (2016) looked into the gender gap in mathematics test scores. The outcome demonstrated that girls consistently achieve lower average test scores than boys do. Nitui Gogoi (2017) inspected distinctions in sexual orientation on students' scholarly accomplishment of auxiliary school. The findings demonstrated that secondary school students' academic achievement is majorly influenced by gender. Eze, Obidile, and Okotubu (2020) investigated the retention and academic achievement of auto mechanic technology students at technical colleges in Nigeria's Delta State. The conclusion was that, regardless of gender, male and female students taught auto mechanics technology using the cognitive apprenticeship instructional method performed better and retained more information than students taught using the demonstration method.

Using the inquiry role instructional model, Aniodoh and Egbo (2013) investigated the effect of gender on students' chemistry achievement. The discoveries of the review uncovered that students educated with request job educational model accomplished higher than those instructed with interpretive strategy. Women taught with inquiry role

instruction model outperformed their male counterparts, according to the study. Bichi (2015) investigated the gender disparity in English Language and Science Secondary School students' performance in Nigeria's Kano State. The study found that students' English performance was below average and that there was a gender difference.

A significant gender difference was also found in school location. In both rural and urban schools, female students performed above average, while male students performed below average. Bichi, Suleiman, and Ali (2019) investigated the effects of gender and the nature of the school on students' mathematics achievement in Kano State. The discoveries of the review uncovered a huge distinction in sexual orientation in math execution. Additionally, there was a difference in the type of school, as day school students performed better than boarding students. Filgona and Sababa (2017) investigated the impact of gender on geography academic achievement among students in Nigeria's Ganye Educational Zone. The study found that female students who were exposed to the mastery learning strategy for learning geography performed better than male counterparts. Likewise, the connection impact of treatment and orientation on students' accomplishment in Topography was critical. Students' gender-related choices and physics performance were the subject of an investigation by Jugovic (2017).

The result of the review uncovered that young ladies had a lower-self-idea of capacity and lower hopes of progress in material science contrasted with young men's notwithstanding their higher physical science school grades. According to a hierarchical regression analysis, girls' lower educational outcomes were related to physics.

2.3.8 Gender and Student's Attitude in MWPs

Wayar (2017) investigated the gender-based attitudes of students in northern Nigeria toward English. Female students developed a more positive attitude toward English than their male counterparts, indicating that gender played a significant role in secondary language learning. Heng and Karpudewan (2015) investigated how gender and grade level influence students' attitudes toward studying chemistry in secondary school. Gender and grade level were found to have a significant impact on attitudes toward chemistry education. Students' attitudes toward chemistry in secondary school are also majorly influenced by gender and grade level.

Chowdury (2016) conducted a gender-based comparison of secondary school students' attitudes toward mathematics. According to the study's findings, 30% of males and 46.4 percent of females have a very favorable attitude toward mathematics. Additionally, there was no significant difference in male or female students' attitudes toward mathematics in either private or urban schools. However, there was no gender based difference observed in rural, English, or vernacular medium schools. In the education colleges in Ghana, Asare, Parker, Quansah, and Osei-Himah (2018) investigated the effects of gender on the attitudes of teacher trainee students toward the study of science. The study found that student' attitudes regarding their performance and participation in science lessons did not differ majorly by gender.

In the Ovia North East Local Government Area of Edo State, Imasuen and Omorogbe (2016) conducted research on the gender influence on junior secondary school students' attitudes toward mathematics. The outcome showed that the mentality of the students towards Mathematics was positive. The concentrate likewise uncovered that there was a contrast between the disposition of male and female students in Mathematics. Sofiani, Maulida, Fadhillah and Sihite (2017) researched distinctions in sexual orientation in concentrate on perspectives towards science. Results showed that students' uplifting outlook towards school was at medium level. Additionally there was no massive contrast in mentality towards school between the female and male students. Gender differences in attitudes toward science methodology for prioritizing contributing factors were investigated by Cheng and Wong (2020). It was discovered that boys and girls displayed a similar hierarchy and gender differences in relation to some but not all construct items. Doreen and Kumiawati (2018) looked at gender differences in how primary school students in Jakarta felt about students with disabilities. The outcome showed that there was no massive contrast in disposition toward the students with handicaps among young men and young ladies.

At Amurie-Omarize, a comprehensive secondary school in Imo State, Amatobi and Amatobi (2020) investigated the effects of gender and attitude on mathematics achievement among students. The outcome demonstrated a significant impact on students' attitudes toward mathematics and accomplishments. Despite not being

statistically significant, boys performed better in mathematics. Boys did better in mathematics than girls did because boys had a more upbeat attitude than girls did.

2.4 Appraisal of Literature

The extant literature indicated that there are many attempts and effort geared towards improving the conventional method of teaching to enhance students' LO in Mathematics. However, several attempts have not really commensurate the desired results as students' performance did not match their enrolment in mathematics at senior secondary school. This can probably be attributed to the strategies that did not allowed students to interact and shared their experiences in the learning context which are supported or allowed by GIS and numbered-heads-together instructional strategies. The two strategies have been suggested as possible remedies that can enhanced learners' academic achievement in and attitude to MWPs. The strategies have been specifically chosen because they give the students ample opportunity to be an active participant in the learning environment. Reviewed literature has shown that both G1S and NHS have the capacity to improve students LO and afford the students opportunity to express their idea freely in the learning process.

However, as seemingly important as these strategies are none of these strategies has been adopted in mathematics classroom instructional activities to the researcher's knowledge in Oyo State, Nigeria. Therefore, this research examined the effects of G1S and NHS on students LO in MWPs. Reviewed literature revealed a strong relationship between verbal ability and students learning outcomes. Gender is another important factor that can influence any strategies if it is not taken into consideration. There is empirical evidence that supports the students' gender effect on attitude and academic achievement in mathematics.

However, the literature reviewed on a GIS and numbered-heads-together instructional strategies did not showed gender and verbal ability as moderator variables on attitude of students to, and Achievement in MWPs being investigated in Oyo North Senatorial District, Nigeria.

CHAPTER THREE

METHODOLOGY

This chapter focused on the research design, variables of the study, selection of participants, and instrumentation. Other items discussed in this chapter include the research procedure, method of data analysis, and validation of the instruments.

3.1 Research Design

The study adopted a pre-test, post-test control group, non-randomized, non-equivalent, quasi-experimental design using a 3x2x2 factorial matrix. The design is shown below:

E_1= O_1 X_1 O_2

E_2 = O_3 X_2 O_4

O = O_5 O_6

Where O_1, O_3, O_5 represents the pre-test, and O_2, O_4, O_6 represents the post-test

E_1 = Experimental group l (Group investigation strategy)

E_2 = Experimental group 2 (Numbered-Heads-Together)

O- Control group (Conventional Strategy)

X_1 and X_2 are the Group Investigation Strategy (GlS) and Numbered-Heads-Together strategy (NHS). At the same time, C is the conventional strategy (CS).

Tables 3.1: Layout of 3x2x2 factorial matrix

Treatment	Verbal ability	Gender	
		Male	Female
Group investigation strategy (GIS)	High		
	Low		
Number-Heads-Together Strategy(NHS)	High		
	Low		
Conventional Teaching strategy(CTS)	High		
	Low		

3.2 Variables of the Study

The variables of the study were grouped into three, namely:

- Independent variable
- Moderator variable
- Dependent variable

Independent Variable: The independent variable in this research is instructional strategies which was manipulated at three levels.

(l) GIS (ii) NHS (iii) CTS

Moderator variable: The moderator variables are two, namely,

(i) Gender and (ii) Verbal Ability

Gender was classified at two levels (i) Male and (ii) Female.

Verbal ability was at two levels.

(i) High (ii) Low

Dependent Variable

Mathematical Achievement in MWPs as represented by scores from the mathematics word problem achievement test

Attitude towards MWPs as measured by Mathematics

Word Problem Attitude Scale (MAWPAS).

3.3 Population

The population for this research comprised all senior secondary students in Iseyin, Itesiwaju, and Kajola Local Government Areas of Oyo North Senatorial District while the target population is SS1I students. They were considered because they had enough time for the experiment (unlike SS3) that would be getting ready for public examinations. Besides, they are perceived to be mature enough, willing, and free to express their opinion and Achievement in MWPs.

3.3.1 Selection of Content/ Topic

The contents were based on Arithmetic and algebraic concepts in mathematics. This is because Arithmetic and Algebraic are more amenable to word problems and are

approved in the curriculum of the Federal Republic of Nigeria (FGN.2013). Thus, the contents covered were:

Arithmetical processes involving fractions, ratios, proportions, decimals, percentages, averages, and progressions, together with their word problem applications.

Algebraic processes involving simplification, variations, and solutions to linear equations, simultaneous equations, quadratic equations, and application to word problems.

3.3.2 Sample and Sampling Technique

Three (3) Local Government Areas were randomly selected from the existing thirteen local Government areas of Oyo North Senatorial District. Three senior secondary mixed schools were randomly selected from each local government area, making a total of nine secondary schools. The entire class of senior secondary school II students was used per school. The participants were randomly assigned to each of the control and experimental groups.

3.4 Research Instruments

The following seven research instruments were validated and used

1. Stimulus instruments:

   Group investigation instructional guide (GIIG)

   Numbered - heads - together instruction guide (NHTIG)

   Conventional strategy instruction guide (CSIG)

   Teacher evaluation sheet (TES)

2. Response Instruments:

   Mathematics Word Problem Achievement Test (MAWPAT)

   Mathematics Word Problem Attitude Scale (MAWPAS)

   Verbal Ability Test (VAT)

3.4.1 Mathematics Word Problem Achievement Test (MAWPAT)

The instrument has two different sections. Section A and B. Section A elicits information on the school's name, sex, and age. Section B contains 60 items of multiple choice tests with four options, A, B, C, and D, by the curriculum. Also, the items were

spread to measure knowledge, understanding, and thinking. Scoring was an award of one mark for each question answered correctly, with a maximum of 60 marks. The instrument was given to experts in mathematics education to establish its content and face validity. The test was tested for reliability and internal consistency by administering it to SS II students, different from the main study. Thirty of the items were bad and struck out, while thirty were found to be good and retained. The items' average difficulty and discrimination indices were determined to ensure that they are neither too difficult nor too simple and also to ensure that they are acceptable. The thirty items fall between 0.44-0.52 difficulty index and discrimination index above 0.36.Also, a reliability coefficient of 0.88 was obtained using Kuder- Richardson (KR20).

Table 3-2: of Specification Table for Mathematics Word Problem Achievement Test (MAWPAT)

S/N	Content Area	Behavioural Objective			
		Knowledge	**Understanding**	**Thinking**	**Total**
1.	Word problems leading to linear equation	3, 16, 17, 23, (5)	13, (1)	10, 24 (2)	8
2.	Word problems leading to quadratic equation	19, 20, (2)	21, (1)	21 (1)	4
3.	Word problems leading to simultaneous equation	- -	11, 12, 15 (3)	-	3
4.	Word problems involving Arithmetic progression	26, 27, (2)	- -	-	2
5.	Word problems involving geometric progression	- -	29, 28 (2)	-	2
6.	Word problems involving fractions and proportions	8, 9, 4, 7, (4)	- -	5, 14 (2)	6
7.	Word problems involving ratios and percentage	1, 2, 30 (3)	6, 25, (2)	-	5
	Total	16	9	5	30

3.4.2 Mathematics Word Problem Attitude Scale (MAWPAS)

This contains a 40-item mathematics attitude scale. The poll was adjusted from the Attitude Towards Mathematics Scale (ATMS) by Tapia (1996) to get reactions from the students on their demeanor toward MWPs. It comprises two segments. Segment An arrangement with the bio-information of the students like name, sex, and class. Segment B contains 40 items, including positive and negative-phrased things. It has a Likert size of four-levels comprises unequivocally Concur (SA), Concur (A), Dissent (D), and certainly deviate (SD) and was scored as 4, 3, 2, 1 individually. The adversely phrased question scores were switched. It was in the request 1, 2, 3, and 4. Things are still up in the air by preliminary testing on SS 2 students, different from the chosen schools of the fundamental study. Copies of the instruments were given to science instruction specialists for content and face legitimacy. Remarks, reactions, and ideas were invited to alter the last duplicate of the instrument. Thirty-seven of the things were viewed as remarkable and held, while three of the things were awful and struck out. The dependability coefficient of 0.85 was obtained with the utilization of Cronbach Alpha.

3.4.3 Verbal Ability Test (VAT)

The verbal ability test was adapted from the Australian Council for Educational Research Test (ACERT). A portion of the items was revamped, and some of the items and names were utilized in the trial to mirror the nearby Nigeria setting. The text comprises both mental and verbal capacity tests. The analyst adjusted just verbal ability perspective.

The test contains 15 items of different decision tests with six choices, 1, 2, 3, 4, 5, and 6. The students were grouped into verbal capacity levels in the accompanying request: 8-15 were grouped as high verbal capacity, while 0-7 imprints were sorted to the low verbal capacity level. Before, the specialists resolved the instruments' fittingness by exposing them to a dependability test utilizing Ruder-Richardson (KR20) formula. Ajiboye (1996) got an unwavering quality of 0.86, Jiboku (1998) got a dependability score of 0.86, and Agunloye (2014) revalidated it and utilized it at 0.86. It was revalidated by the specialist with the end goal utilizing the individual's item second

relationship, and a dependability coefficient of 0.81 was obtained. The face and content legitimacy of the instrument was done by a master in the field of mathematics education. The instrument was taken for a pilot study and controlled by 100 students' who were not part of the study. Examination of the items was completed to lay out the trouble file and the segregation record. Items with trouble records between 0.401-0.602 were chosen, while the separation file of > 0.3 was likewise utilized.

3.4.4 Instructional Guide for Group Investigation Strategy (IGGIS)

The Researcher created the G1 unified learning system informative aid. The quintessence of the manual arrangement is to direct the examination aide that would be co-selected with the study and to familiarize them with standards, ways, and habits in which GI-suitable learning techniques could be organized. The aide examined the ideal group size and tasks of members to groups, the study hall game plan, and the job of individual members. Likewise, the aide showed the characteristics of the technique and assessment process for regulating the philosophy in a coordinate way that is simple for any mathematics educator to utilize. The aide was given over to science specialists in the office for approval. The between rater unwavering quality of the item set in stone by Scott Pi. The worth of 0.78 was acquired as the dependability list, which showed arrangement among the ratters, making it solid for use.

3.4.5 Instructional Guide for Numbered-Heads-Together Strategy (IGNHS)

The researcher created the informative aide for the organization of numbered-heads- together with helpful learning techniques. The pith of the arrangement is to direct the co-selected examination partner to illuminate them with the habits in which numbered - heads-together suitable learning techniques can be applied. The aide examines the group size and task of members to the group, homeroom course of action and the board, organizing of agreeable ability, anticipated standards and elements of members, and the straightforward job of individual members. Also, the aide features the characteristics of this system and the evaluation strategy for managing the technique in a sort out way simple for any arithmetic educator to utilize. The instrument was subsequently given to the teacher in the office for approval. The Scott Pi was used to decide between ratter

dependability. The worth of 0.76 was acquired as the unwavering quality list, demonstrating understanding among the ratters and making it solid for use.

3.4.6 Guide for Conventional Instructional Method (GCIM)

The researcher developed the instructional guide. Its procedures include an introduction, discussion, and evaluation, which are in steps. The guide was given to mathematics experts. The ratings of the instrument were subjected to Scott Pi. A reliability index 0.78 was obtained, indicating agreement among the raters, making the instrument reliable.

3.4.7 Evaluation Form for Assessing Mathematics Teacher's performance during Training (EFAMTP)

The instruments were applied in assessing research assistants for efficient application of the guides, group investigation strategy, Numbered Heads Together and conventional teaching strategy. The instrument has sections A and B. Section A elicits information on the demographic variables. Section B highlights essential areas of the research of which the research assistant was assessed on the following: possession in Mathematics Education, a first-degree certificate, enough experience in teaching, and the capability of the research assistant to demonstrate dedication to the research work. More so, the ability of the assistant researcher to select participants into study groups, assign duties to participants, and capability to assess the quantity and quality of group learning.

3.5 Research Procedure

The researcher first administered the instruments as a pre-test to the students, and their scores were recorded. The Experimental group I and II were then exposed to concepts in Mathematics Word Problems using group investigation strategy and Numbered Heads Together for eight weeks. The control group was also exposed to conventional strategies for the same weeks. The following time schedules were used for the study.

First two weeks for research assistant training.

- ✓ pre-test administration-one week
- ✓ treatment and follow up-eight weeks
- ✓ post-test administration-one week

Total: Twelve weeks.

3.5.1 Administration of Pre-test

All the participants (the two experimental and the control groups) were subjected to the pre-tests by the research assistant using the evaluation instruments (MAWPAT, MAWPAS and VAT) before the treatment began. The students' scripts were marked, and their scores were collated. The assessment of the research assistants trained for the study was also collected and rated. The students' scores obtained were used to indicate the level of knowledge already possessed by the students before the administration of the treatment, and this assisted the researcher in making a sound judgment at the end of the study.

3.5.2 Instructional Guide

The researcher sought the cooperation of school Principals and teachers. The SS II mathematics teachers were trained in applying the strategies in two weeks. The researcher demonstrated the learning techniques to the teachers and later told them about the practice. The experimental group I and II teachers were given the GIS and NHS instructional package guides, respectively. The teachers for the control groups were also given a conventional instructional guide.

3.5.3 Treatment Procedure

a. Instructional Guide for the Experimental Group 1 (Group investigation).

Step 1: Splitting of students into groups

Activity (i): Students are organized into task-oriented groups of about five students in a heterogeneous group regarding gender and academic ability.

Activity (ii): The members of each group choose a leader for each group

Step 2: Splitting of the concept

Activity (i): The teacher breaks the topic into subtopics and tells the students to choose their own.

Activity (ii): Students plan a variety of learning procedures, tasks, and objectives in line with the chosen subtopics.

Step 3: Execution of plan by the students.

Activity (i): Groups carry out the plan formulated in the second step using a variety of learning activities and skills.

Activity (ii): The teacher monitors and assists if needed.

Step 4: Planning of group presentation

Activity (i): Groups analyse their information. Itemize the main idea of their investigation. Constitute a steering committee to conduct their presentation and plan how to present their findings so the class

Activity (ii): The teacher teaches students presentation skills such as speaking clearly, concisely, and capturing the audience's attention.

Step 5: Presentations by various groups of students

Activity (i): All the groups make their presentations.

Activity (ii) The teacher supervises the presentations and make corrections

Step 6: Evaluation of various groups and learning objectives

Activity (i): The teacher evaluates the investigation result and presentations.

Achievement of groups is assessed.

Activity (ii): Exercises containing MWPs are given to students to evaluate the objectives of the lesson

Step 7: Summary and Assignment

Activity: The teacher summarises the lesson and gives an assignment to

b. Instructional guide for the Experimental Group 2 (Numbered-heads- together strategy)

Step 1: Splitting of students into groups

Activity: Students are divided into small groups comprising about five(5) students per group, which is heterogeneous regarding gender and academic abilities.

Step 2: Numbering of students in various groups

Activity: Students in each group are numbered (1,2, 3,4, 5).

Step 3: Provision of problem/tasks for students

Activity: The teacher provides the problem/task for the students

Step 4: Solution of problem/task by students

Activity: Students assist one another in solving the problem. The group strives to make sure that every group member can solve or answer the question given.

Step 5: Calling of a number at random in various group

Activity (i): The teacher calls a number at random

Activity (ii): The students that possess the number answers and earn points for their group

Step 6: Evaluation of learning objectives

Activity (i): Each group of students reviews their performance and assesses their strategies.

Activity (ii): Exercises containing MWPs are given to students to evaluate the learning objectives

Step 7: Summary and assignment

Activity: The teacher summarises the lesson and gives an assignment to the

c. Instructional Guide for the Control group (Conventional method)

Step 1: **Introduction**

Activity (i): Their teachers asked The students simple questions based on their

Activity (ii): The students answer the questions asked by the teacher

Step 2: Activity (i): **Presentation of the topic**

The teacher explains the concept in detail

Activity (ii): The teacher teaches the students a symbolic representation of mathematics word problem

Step 3: **Presentation of the concept in a sequential order**

Activity: The teacher follows the sequential order of the lesson as stated outline of the note of the lesson

Step 4: **Clarification by the students**

Activity (i): The teacher allows the students to ask questions on areas that Them

Activity (ii): The students ask questions seeking clarification on areas that them.

Step 5: **Answering of the Students' Questions, by the teacher**

Activity: The teacher answers the students' questions adequately using Instructional material prepared for the lesson.

Step 6: **lesson objectives evaluation**

Activity (i): The students are given questions by their teacher to solve as

Activity (ii): The students solve and submit them to the teacher for

Step 7: **Summary of the lesson**

Activity: The teacher summarises the whole lesson and gives the Questions to solve as homework.

3.5.4 Administration of Post-test

The participants (experimental and control groups) were given the post-test after the treatment period using the evaluation instruments (MAWPAT, MAWPAS, and VAT) with the aid of research assistants. The students' scripts were marked, and their scores were collated. The scores obtained by students were used to ascertain the impact of GIS and NHS on students' outcome to MWPs.

3.6 Methods of Data Analysis

Descriptive and inferential statistics were used to analyze the data collected. ANCOVA was used to test the formulated hypotheses at 0.05. Bonferroni post hoc and differential mean scores were used to determine the source of the significant effect of treatment and the magnitude of the scores, respectively.

CHAPTER FOUR

RESULTS AND DISCUSSION

The interpretations of the results of the statistical analysis of the data generated in the study were presented in this chapter. The null hypotheses were tested at 0.05 level of significance. The presentations are in line with the order of arrangement of the hypotheses.

Presentation of Descriptive Findings

Table 4.1: Distribution of the Participants by Treatment, Gender, and Verbal Ability

Variables	Frequency (N)	Percentage (%)
Treatment groups		
GIS (GIS)	225	38.3
Number Head Strategy (NHS)	190	32.4
Conventional Strategy (CS)	172	29.3
Total	587	100.0
Gender		
Male	266	45.3
Female	321	54.7
Total	587	100.0
Verbal ability		
Low	241	41.1
High	346	58.9
Total	587	100.0

Five hundred and eighty-seven students were the participants in this study, with 225 in the group investigation strategy (G1S), 190 in the numbered- heads-together strategy (NHS) and 172 in the main group (CS). The study population comprises two hundred and sixty-six (266) male students and three hundred and twenty-one (321) female students.

Answering of Research Question

Research question 1: What is the level of students' verbal ability in mathematics word problems?

Table 4.2: Students' verbal ability in mathematics word problems

Score range	Level	Frequency	Percentage (%)
0-8	Low	346	58.9
9-15	High	241	41.1
Total		587	100.0
Mean = 7.96			
Standard deviation = 2.00			
Criterion mean = 8.00			

Table 4.2 revealed that 346 (58.9%) of the students had low verbal ability in mathematics word problems, while 241 (41.1%) had high verbal ability in mathematics word problems. Table 4.2 further revealed a mean score of 7.96, which is less than the criterion mean of 8.00. This implies that majority of the students' verbal ability in mathematics word problems is low.

4.1 Testing of Null Hypotheses

H01a; There is no significant main effect of treatment on students' achievement in mathematics word problems

Table 4.3: Analysis of Covariance (ANCOVA) of Post-Achievement by Treatment, Gender and Verbal ability

Source	Type III Sum of Squares	Df	Mean Square	|F	Sig.	Partial Eta Squared
Corrected Model	2726.871	12	227.239	49.968	.000	.511
Intercept	1128.110	1	1128.110	248.060	.000	.302
Achievement	1049.187	1	1049.187	230.705	.000	.287
Treatment	323.446	2	161.723	35.561	.000*	.110
Gender	.119	1	.119	.026	.872	.000
Verbal ability	154.116	1	154.116	33.889	.000*	.056
Treatment x Gender	2.404	2	1.202	.264	.768	.001
Treatment x Verbal	23.467	2	11.734	2.580	.077	.009
Gender x Verbal ability	2.354	1	2.354	.518	.472	.001
Treatment x Gender x Verbal ability	16.162	2	8.081	1.777	.170	.006
Error	2610.403	574	4.548			
Total	77247.000	587				
Corrected Total	5337.274	586				

R Squared = 0.51 (Adjusted R Squared = 0.50) * denotes significant $p<0.05$

Table 4.3 showed a critical fundamental impact of treatment on students' accomplishment in science. Table 4.2 shows the impact size of 11.0%. This implies that 11.0% of the absolute 50.0% variety noticed (Changed R^2 =0.50) in students' post accomplishment scores in MWPs in this ANCOVA model came about because of the huge principal impact of the treatment. In this way, hypothesis 1a was dismissed. To investigate the size of the critical principal impact across treatment gatherings, the Differential Mean scores were computed on the treatment gatherings, and the outcome is introduced in Table 4.4.

Table 4.4: Differential Mean scores for Post-Achievement by Treatment and control group

			95% Confidence Interval	
Treatment	Mean	Std Error	Lower Bound	Upper Bound
Group Investigation (GIS)	11.61	0.15	11.32	11.90
Number Head Strategy (NHS)	11.26	0.16	10.95	11.57
Conventional Strategy (CS)	9.75	0.18	9.40	10.09

Table 4.4 shows that students in the GIS experimental group 1 had the highest adjusted mean score in their post-achievement in MWPs (11.61), as against the Number-Heads- Strategy (NHS) experimental group 2 (11.26) then the Conventional Method (CM) control group (9.75). GIS> NHS > CM represents this trend. Below is the result of the Bonferroni post-hoc test to determine the extent of differences in the efficacy of the treatment

Table 4.5: Bonferroni Post-hoc Analysis of Post-Achievement by Treatment and Control Group

(1) Treatment	(J) Treatment	Mean Difference (1-J)	Sig-
Group Investigation (GIS)	Number Head Strategy	.354	.296
	Conventional Strategy (CS)	1.865	0.000*
Number Head Strategy (NHS) Strategy	Group Investigation	-.354	.296
	Conventional Strategy (CS)	1.511*	0.000*
Conventional Strategy (CS)	Group Investigation Strategy	-1.865*	0.000*
	Number Head Strategy	-1.511*	0.000*

Table 4.4 showed that the post-accomplishment mean score in MWPs of students in the Investigation Group was different from those in the Numbered-Heads- Technique; however essentially unique to those presented to the Ordinary System. Likewise, the distinction in the post-accomplishment mean scores of students in the numbered-heads-system and those in the conventional technique was critical. This suggests that the massive difference seen in the ANCOVA result was not because of the contrast between the treatment groups (GIS and number head techniques) yet between the treatment groups and the benchmark group as students' post-accomplishment scores in MWPs are concerned.

HO1b: There is no huge fundamental impact of treatment on students' attitude to MWPs

Table 4.6: Analysis of Covariance (ANCOVA) of Post-Attitude by Treatment, Gender and Verbal ability

Source	Type 111 Sum of Squares	df	Mean Square	F	Sig-	Partial Eta Squared
Corrected Model	60770.355	12	5064.196	41.002	.000	.462
Intercept	31075.263	1	31075.26	251.598	.000	.305
Pre Attitude	47599.164	1	47599.16	385.382	.000	.402
Treatment	7625.053	2	3812.526	30.868	.000*	.097
Gender	30.696	1	30.696	.249	.618	.000
Verbal ability	161.078	1	161.078	1.304	.254	.002
Treatment x Gender	222.941	2	111.471	.903	.406	.003
Treatment x Verbal	235.481	2	117.740	.953	.386	.003
Gender x Verbal	.600	1	.600	.005	.944	.000
Treatment x Gender x Verbal ability	91.809	2	45.905	.372	.690	.001
Error	70895.717	574	123.512			
Total	7139644.000	587				
Corrected Total	131666.072	586				

R Squared = .46 (Adjusted R Squared = .45) * denotes significant p<05

Table 4.5 showed a significant effect of treatment on students' attitude to MWPs ($F_{(2,585)} = 30.87$; $p<0.05$, partial eta squared= .10). Table 4.5 uncovered and impact size of 10.0. This infers that 10% of the total 45% variety noticed (adjusted $R^2 = .45$) in students' post-attitude scores in MWPs was because of the huge primary impact of the treatment. Accordingly, thesis lb was dismissed. To probe the size of the huge abecedarian impact across treatment groups, the assessed supplemental means were carried out on the treatment groups, and the outgrowth is displayed in Table 4.7.

Table 4.7: Differential Means scores of Post-Attitude by Treatment and Control group

Treatment	Mean	Std. Error	95% Confidence Interval Lower	Upper Bound
GIS	111.81	.77	110.31	113.32
Number Head Strategy	111.44	.82	109.82	113.05
Conventional Strategy (CS)	103.25	.91	101.45	105.04

Table 4.7 uncovered that students in the GIS treatment group 1 had the highest adjusted mean score in their post-attitude to MWPs (111.81) as against those in the Numbered-Heads-Together (NHS) treatment group 2 (111.44) and the Conventional system (CS) control group (103.25). This pattern is addressed GIS > NHS > CS.

Below is the result of the Bonferroni post-hoc test to determine the extent of differences in the participants' attitudes to MWPs

Table 4.8: Bonferroni Post-hoc Analysis for Post-Attitude by Treatment and Control Group

(1) Treatment	(J) Treatment	Mean Difference (1-J)	Sig-
Group Investigation (GIS)	Number Head Strategy (NHS)	.376	1.000*
	Conventional Strategy (CS)	8.565*	.000*
Number Head Strategy (NHS)	Group Investigation ID Strategy	-.376*	1.000*
	Conventional Strategy	8.189*	.000*
Conventional Strategy (CS)	Group Investigation Strategy	8.565*	.000*
	Number Head Strategy (NHS)	-8.189*	.000*

* denotes significant p<.05

Table 4.8 showed that participants' post-attitude mean score in MWPs in the group investigation was not majorly different from those in the NHS but differed majorly from those in the conventional method. The distinction between the students' post-attitude means scores in the NHS and those in the conventional system was enormous. This suggests that the considerable contrast seen in the ANCOVA result was not because of the distinction between the treatment groups (GIS and NHS) yet between the treatment groups and the benchmark group as students' post-attitude scores to MWPs are concerned.

Ho2a; There is no significant main effect of gender on students' achievement in MWPs

Table 4.2 showed no significant main effects of gender on students' achievement in MWPs ($F_{1,586}$) = .03; p>.05, partial eta squared = 0.00). In this way, hypothesis 2a was not dismissed. One could infer that gender did not affect students' achievement in MWPs.

Ho2b: There is no significant main effect of gender on students' attitude to MWPs

Table 4.5 uncovered that the main effect of gender on students' attitude to MWPs ($F_{1,586}$) = 0.25; p>.05, partial eta squared= 0.00) was not significant. Accordingly, speculation 2b was not dismissed. This infers that gender did not meaningfully affected students' attitude to MWPs.

Ho3a: There is no significant main effect of verbal ability on students' achievement in MWPs

Table 4.2 demonstrated that there was a significant main effect of verbal ability on students' achievement in MWPs ($F_{1,586}$ = 33.89; p≤05, partial eta squared = 0.06). Thus, speculation 3a was dismissed. One could infer that verbal ability affected students' Achievement in MWPs. Table 4.1 uncovered the impact of 6.0%, implying that the primary effect of verbal ability brought about 6.0% of the variety in students' post-achievement scores in MWPs. To determine the extent of the post-achievement mean scores of students across verbal ability, the differential means examination was computed, and the outcomes were displayed in Table 4.9.

Table 4.9: Differential means scores for Post-Achievement by Verbal ability

Verbal ability means Std. Error 95% C.I

			95% Confidence Interval	
Verbal Ability	Mean	Std. Error	Lower Bound	Upper Bound
Low	10.24	0.16	9.92	10.55
High	11.51	0.13	11.26	11.76

Table 4.9 showed that high verbal ability students had adjusted mean score of 11.51, as against students with low verbal ability with adjusted mean score of 10.24. This pattern is addressed as High > Low. This suggests that high verbal ability students had a superior Achievement in MWPs, and this distinction is significant.

Ho3b: There is no huge fundamental impact of verbal capacity on students' disposition to MWPs

Table 4.6 demonstrated no critical fundamental impact of verbal capacity on students' mentality toward mathematics. ($F_{(1, 586)} = 1.30$; $p>.05$, partial eta squared = 0.002). Thus, speculation 3b was still being accepted. One could infer that verbal capacity did not majorly affected students' disposition to MWPs.

Ho4a: There is no critical connection impact of treatment and gender on students Achievement in MWPs

Table 4.3 showed that the association impact of treatment and gender on students' accomplishment in MWPs was not critical ($F_{(2,585)} = .26$; $p>0.05$, partial eta squared = 0.001). Subsequently, speculation 4a was not dismissed. This suggests that treatment and gender did not affect students ' Achievement in MWPs.

Ho4b: There is no huge cooperation impact of treatment and gender on students' mentality to MWPs

Table 4.6 showed no huge communication impact of treatment and gender on students' demeanor to MWPs ($F_{(2,585)}=0.90$; $p>0.05$, partial eta squared=0.003). Consequently, theory 4b was not rejected. Treatment and gender did not affect students' disposition to MWPs

Ho5a: There is no critical association impact of treatment and verbal capacity on students' Achievement to MWPs.

Table 4.3 demonstrated that there were no critical connection impact of treatment and verbal capacity on students' Achievement in MWPs ($F_{(2, 585)} = 2.58$; $p>.05$, partial eta squared=.01). Thus, speculation 5a was not dismissed. Treatment and verbal capacity did not affect students ' Achievement in MWPs.

Ho5b: There is no huge cooperation impact of treatment and verbal capacity on students ' mentality to MWPs.

Table 4.6 demonstrated no huge connection between treatment and verbal capacity on students' demeanor to MWPs ($F_{(2,585)} = .95$; $p > .05$, partial eta squared = .003). Thus, theory 5b was not rejected. Treatment and verbal capacity did not meaningfully affected students ' disposition to MWPs.

Ho6a: There is no huge cooperation impact of gender and verbal capacity on students' Achievement in MWPs

Table 4.3 showed that the connection impact of gender and verbal capacity on students' Achievement in MWPs was not critical ($F_{(1,586)} = 0.52$; $p > 0.05$, partial eta squared = 0.003). Consequently, speculation 6a was still being not rejected. Orientation and verbal capacity did not majorly affected students ' Achievement in MWPs.

Ho6b: There is no critical connection between gender and verbal capacity on students' demeanor to MWPs.

Table 4.6 uncovered that the impact of gender and verbal capacity on students' disposition to MWPs ($F_{(1,586)} = .01$; partial eta squared = 0.00) was not huge. Subsequently, theory 6b was not rejected. Gender and verbal capacity did not meaningfully affect the mentality of students to MWPs.

Ho7a; There is no huge collaboration impact of treatment, gender, and verbal capacity on students ' Achievement in MWPs

Table 4.3 uncovered that there was no huge collaboration impact of treatment, gender, and verbal capacity on students' accomplishment in MWPs ($F_{(2,585)} = 1.78$; $p > .05$, partial eta squared = 0.01). Hence, speculation 7a was not dismissed. This shows that treatment, gender, and verbal capacity did not majorly affected students' MWPs accomplishment.

Ho7b: There is no huge association impact of treatment, gender, and verbal capacity on students' disposition to MWPs

Table 4.6 showed that the connection impact of treatment, gender, and verbal capacity on students' mentality to MWPs ($F_{(2,585)} = .37$; $p > 0.05$, partial eta squared= 0.001) was not huge. In this manner, speculation 7b was not dismissed. This demonstrates

that treatment, gender, and verbal capacity did not affect the mentality of students to MWPs.

4.2 Discussion of Findings

On the first hypothesis, the outcome showed a critical fundamental impact of treatment on students' Achievement in MWPs. Students' in the treatment group one presented to G1S had the most elevated changed mean score in their post Achievement in MWP (11.61) as against the groups in the Numbered-Heads-Together learning technique (NHS) in the treatment group 2 (11.26) and their partners in the Conventional Method (CM) control group (9.75) separately. The discoveries uncovered that GIS and NHS educational methodologies were more compelling than the traditional technique in the accomplishment test in MWPs. The viability of these two systems might be connected to the understudy's dynamic support, conversation, and deliberate reasoning of the ideas shown in the procedure. It is likely because of the students' inspiration and support implanted in the two systems.

Likewise, the outcome shows that the post-accomplishment mean score in MWPs of students in the GIS is different from those educated with the Conventional Method (CM). The viability of a GIS might be because of its capacity to work with students with decisive reasoning, get clarification on some pressing issues, and have an amazing chance to communicate their thoughts.

GIS guarantees that students ask about the point and learn and that others learn, combine, and expound on the discoveries of every part for legitimate comprehension and transparency of thoughts or, more all, students have conceded independence in the investigation cycle. This committee develops and sets students understanding and growing experience. The viability of the GIS is on the side of the theory of social reliance. This theory expresses that singular objective-orientated exertion adds to another objective achievement. Students' gifts supplement each other inside the group, so the group works to help each other through powerful correspondence, common assistance, and valuable administration of contention to get done with a job, accomplish or create to arrive at the group objectives.

The outcome of the viability of the GIS upholds the finding of Ebele and Abubakr (2019), which uncovered that students presented to GIS showed a huge distinction from those presented to the conventional system in the Science class. The viability of the after effect of the GIS likewise under the discoveries of Abdul Gani, Asyik, and Zaiyana (2016), which showed that the students instructed with the GIS came by improved brings about perusing than the people who were shown utilizing the standard individual perusing movement technique.

Numbered-Heads-Together Procedure was viewed as more successful than the conventional system. This may be because students were permitted to interface with each other and be responsible for learning the materials, as each part should be self-directed and prepared to address the group. Nobody is permitted to accept the job of someone else. The methodology likewise guarantees equivalent cooperation of students since each part gets the opportunity to answer the inquiry. Additionally, contest and collaboration among the students are expanded hugely. The technique likewise improves understudy inspiration, learning, and fearlessness.

The after effect of the viability of the NHS methodology over traditional procedure is on the side of social advancement theory, which expresses that "each capability in the youngster's social improvement shows up two times: First on the social level and later individual level. Mental cycles are the aftereffect of social collaborations. The theory zeroed in on association among individuals and the social setting in which they act, cooperate, and share encounters. Instructors need to establish a learning climate where students collaborate with each other to find things without anyone else. This would assist them with becoming dynamic members of the learning setting. The consequence of the adequacy of the NHS is on the side of the discoveries of Norzubaidah (2019), which uncovered that the Number-Heads-Together System is a successful approach to learning science among auxiliary school students. It likewise loans assurance to the finding of Naibaho (2019), which presumed that the utilization of NHS could build students' actions and students' learning accomplishment in learning English. It is additionally on the side of the discoveries of Leasa and Corebima (2017), which showed the distinction in students' mental accomplishment in view of learning models and the general scholarly capacity of the students in inherent science.

On the second hypothesis, the outcome uncovered a critical fundamental impact of treatment on students' demeanor toward MWPs. The outcome demonstrated that students utilizing the group investigation strategy treatment group I had the most elevated changed mean score in their post-disposition to MWPs as against their partners in the numbered - Heads-Together procedure and Conventional Strategy. The outcome further showed that the post-disposition mean scores for the MWPs of students in the GIS were not fundamentally the same as those in the Numbered Heads Together yet contrast essentially from those in the regular system. Additionally, the distinction in the post demeanor means scores of students in the Numbered-Heads-Together system and those in the common technique were critical.

The viability of the trial systems might be connected to the social, close-to-home, and mental advantages implanted in the methodologies. It might likewise be because of the way that the two methodologies advance a learning setting by which the students understand that the most effective way to succeed is to team up with their companions and consider each understudy significant, and, as such, is, possibly they do or die together.

The viability of group investigation over both Number-Heads-Together and regular systems might be because of how the technique supports the dynamic commitment of students to examine or ask about the subject. Cooperate or investigate thoughts and help each other to learn. Deciphered or expanded on the discoveries of every part for clearness of thoughts and characteristic inspiration or giving of independence to students in the investigation cycle. This dynamic inclusion likely unquestionable necessity contributed colossally to what the students have realized and how they have learned it. The adequacy of the GIS supports the theory of social reliance, where the singular objective arranged exertion adds to another objective achievement. Understudy gifts supplement each other inside the group with the goal that the group work successfully to help each other through common assistance, viable correspondence, and the board of contention to finish a job. This would thus work on their disposition towards Mathematics word problems.

The discoveries support the discoveries of Kusmaryono, Syitono, and Dwidayati (2018) who explored group investigation strategy in working on students ' good demeanor and numerical power. These outcomes showed that the group investigation strategy in science learning prevailed regarding changing negative attitudes into useful (positive) demeanor toward mathematics and had expanded the students' numerical power. It additionally upholds Wayan et al. (2018), who worked on a GIS on students' decisive reasoning abilities, social mentalities, otherworldly perspectives, and their personalities in learning physical science in senior secondary school. The outcome showed that the group investigation strategy was superior to the coordinate guidance model for accomplishing students 'decisive reasoning abilities, social mentalities, otherworldly perspectives, and personalities in learning material science in senior secondary schools. It likewise loaned belief to the discoveries of Yuandini and Sahyar (2017), who examined the impact of the helpful learning model of group investigation strategy helped streak media. The outcome showed that the applied information on students educated with agreeable learning model group investigation strategy helped streak media better than traditional learning. The understudy's applied information with better-than-expected logical perspectives shows improved results than students with sub-optimal logical mentalities.

While addressing the third hypothesis, this research result demonstrates that there was no principal critical impact of orientation on students' scholastic Achievement in MWPs educating and advancing as displayed in table 4.5. This result can be ascribed to the nature and strategy for a show of guidance embraced in this study. The educational techniques taken on in this research obliged the different orientations of the students as they are conveyed in groups regardless of their orientation; students in the treatment groups showed great execution because of the participatory and comprehensiveness of the systems. Every understudy can be detached from the study hall educational exercises. This research result upholds the discoveries of Sopuruchi (2015), which uncovered the negligible impact of gender on the accomplishment of coordinated science students .

Nonetheless, the aftereffect went against the finding of Ogunleye and Babajide (2011) and Awofala (2011), who found a huge orientation impact on science and math accomplishment for guys. This research result additionally goes against the outcomes of Robinson and Lubienski (2011), Brown and Kanyogo (2010), and Bichi (2015), who tracked down the critical impact of orientation on science and mathematics accomplishment for females.

On the fourth hypothesis, this research result demonstrated no huge primary impact of orientation on students' mentality to Mathematics educating and advancing, as displayed in table 4.6. This suggests that when the instructor utilizes the right methodology during homeroom informative activity, the students ' demeanor is improved no matter the understudy's orientation. The students in this research showed great demeanor to learning because of the degree of the contribution they delighted in because of the techniques embraced. The group investigation strategy improved the quality connection between the educator and the students critically, among the students . This is so because jobs are doled out to every understudy nobody expects someone else's job. The technique additionally permits the educator to care for the group's students . Even frail students are included. The group investigation strategy managed the cost of the understudy a road to assume responsibility for their own inclining through the means framed by the methodology. The result proves the aftereffect of the study by Okoye (2010) and Ghasemi and Burnley (2015), which found no significant difference in science subjects among young men and young ladies concerning their disposition and accomplishment. It also lends credence to the findings of Eze, Obidile and Okotubu,(2020) which found no significant difference among young men and young ladies concerning their retention on auto mechanics taught.

Nonetheless, the outcome went against the discoveries of Wasike (2013), who found that young ladies' perspectives towards science will generally be negative as students move from rudimentary to optional school. It additionally goes against the discoveries of Sax, Kanny, Tiffani, and Whang (2015) and Skavik. Tangen and Federeci (2015) found that male students express a more inspirational perspective toward math than female students. Again, it when against the

finding of Aniodoh and Egbo (2013) who found that young ladies outperformed young men counterpart taught with inquiry role instruction model.

For the fifth hypothesis, this research result demonstrated a huge principal impact of verbal capacity on students' achievement in MWPs education and, advancement, as displayed in Table 4.6. High verbal capacity students had a superior Achievement in MWPs than their partners with low verbal capacity with a huge distinction. This finding is on the side of Adejimi, Nzabalirwa, and Shivoga (2020), who found that high Verbal capacity students had higher scientific accomplishments than their low-verbal-ability partners. It likewise certifies the discoveries of Linda and Lombardino (2019), who observed that Verbal capacity was a major area of strength for learning results, regardless of the kind of educational media. It anyway goes against the discoveries of Olugbeko (2018), whose study showed no tremendous contrast of Verbal ability pre-administration educator's exhibition in perusing appreciation utilizing proportional and semantic planning educational techniques. It also when against the discoveries of Adegbile and Alabi (2007) who found that senior secondary students achievement in English easy writing was majorly influence by verbal ability.

The sixth hypothesis was rejected. The discoveries showed no critical fundamental impact of verbal capacity on the disposition of students to mathematics word problems educating and advancing, as displayed in table 4.6. This outcome infers that students ' disposition to mathematics word problems isn't subject to their verbal capacity but rather to the methodologies embraced by the educator. This outcome proves the discoveries of Okere (2019) which uncovered no effect of verbal capacity on the disposition of students to writing in English. It additionally upholds the discoveries of Olugbeko (2018), whose study showed that verbal capacity did not affects pre-administration educators' exhibition and demeanor to understanding perception.

The outcome of the seventh hypothesis uncovered no critical collaboration impact of treatment and gender on students' scholastic Achievement in MWPs, as displayed in Table 4.6. This shows that no tremendous distinction was kept in the understudy's post-achievement scores across the distinction gender groups. Hence,

the score recorded by students in the post-accomplishment of the study doesn't rely upon their gender but rather on the treatment. This can be credited to the predominance of the methodologies utilized for guidance in the treatment groups. The two procedures taken on for the study energized great participation among the students in their different groups and with their educators in the learning setting. This can be connected to the idea of a more proficient other (MKO) in Vygotsky's social advancement theory. The students in the group investigation strategy benefitted considerably because of the various jobs allocated to each understudy and the introductions of various groups.

Additionally, students in numbered - heads-together helped massively in the study hall educational exercises. Students' abilities supplement each other in the learning setting, which works with procuring and maintaining information regardless of the students' gender. This research results in loans trustworthiness to the discoveries of Echie and Owo (2019), which uncovered no huge distinction in gender of students' accomplishment in Essential Science in Obio/Akpor Neighborhood government Area of Waterway State, Nigeria. This study's aftereffect went against Wordu and Iwok's discoveries (2018), which showed huge contrast between gender and learning climate on students' scholarly accomplishment in science in Akwa Ibom state, Nigeria. It also when against the discoveries of Nyagan and Mugambi (2019) who found that academic accomplishment was unaffected by gender interaction in Kenya's Muranga county.

The outcome of the eight hypotheses in this research uncovered no critical collaboration impact of treatment and gender on the disposition of students to MWPs educating and advancing, as shown in Table 4.6. This suggests that all the students recorded a superior mentality score no matter their gender. Subsequently, the students' post-demeanor scores are flexible to their gender. This can be credited to the prevalence of the procedures embraced, which require no cooperation with students' gender to improve students' demeanor in MWPs. This outcome upholds the discoveries of Asare Parker, Quansah, and Osei-Himah (2018), who found no massive contrast in gender educators' learner students ' demeanor towards the study of science in the universities of training in Ghana. This study's aftereffect went

against Imasuen and Omorogbe's discoveries (2016), which showed a huge distinction between male and female students' mathematics mentality in the Neighborhood government area of Ovia North East of Edo State, Nigeria.

Results show that hypothesis nine is rejected, as shown in table 4.6, demonstrating no huge cooperation of verbal capacity and gender on the scholarly accomplishment of students' MWPs. This suggests that students' scholastic Achievement in MWPs needed to be more sensitive to the setup of gender and verbal capacity. The discoveries show that when the science guide is being taken care of with educational techniques, for example, GIS and NHS, every one of the students , no matter what their gender and verbal capacity joined together, would keep great scholarly Achievement in MWPs. This supports the discoveries of Olugbeko (2018), which showed that the cooperation impact of gender and verbal capacity was small on pre-administration educators' exhibition in perusing understanding when instructed with equal and semantic planning educational systems. Notwithstanding, the unimportant two-way association impact of gender and verbal capacity on students ' Achievement in MWPs went against the discoveries of Akinmusire (2014), who found that female students with high verbal capacity exhibited preferred execution in perusing cognizance over their male partners.

On hypothesis ten, it is obvious from Table 4.6 that there was no huge connection impact of gender and verbal capacity on the mentality of students in mathematics word problems. This demonstrates that the students' post-mentality scores in this research were not delicate to the students' gender and verbal capacity. Up to this point, the study has shown that verbal capacity and orientation affect the mentality of students to mathematics word problems, either principal or communication impact. This finding proves the outcome of Olugbeko (2018), which uncovered no critical cooperation impact of gender and verbal capacity on pre-administration educators' exhibition and demeanor to understanding appreciation. It also lend credence to the findings of Ezenadu (2012), who found that students attitudes toward English prose literature were not majorly impacted by

treatment. Students mentality toward English prose literature and achievement were unaffected by verbal ability and gender.

The ramifications of this finding are that the reception of imposing informative systems, for example, group investigation strategy and numbered heads-together, improved the students' demeanor to learning no matter their gender and verbal capacity. This is because of the Students' full cooperation in the educational experience and playing key jobs in their learning setting.

On hypothesis 11, the aftereffect showed no huge three-way communication impact of treatment, gender, and verbal capacity on the educational accomplishment of students in MWPs. One could infer that verbal capacity and gender association impacts didn't upgrade the students' scholarly accomplishment. There has not been any critical fundamental impact of gender on the scholarly accomplishment of students in this study. This can be credited to the adequacy of the methodologies embraced for this study. The systems upgraded students' scholarly accomplishment no matter what the students' gender or the cooperation of gender and verbal capacity. This supports the discoveries of Olugbeko (2018), which found no critical three-way cooperation impact of complementary educating and semantic planning, verbal capacity, and gender on pre-administration educators' exhibition in and disposition to understanding perception. The outcome further burdens the utilization of systems that laid accentuation on constructivist standards. The constructivist theory urges students to incorporate and build information utilizing their knowledge.

Data obtained from Table 4.6 showed that for hypothesis 12, there were no huge three-way connection impacts of treatment, verbal capacity, and orientation on the disposition of students towards MWPs. This demonstrates that students ' post-demeanor scores aren't subject to the communication impacts of orientation and verbal capacity, however, on the treatment utilized in this study. This supports the discoveries of Olugbeko (2018), which showed no critical collaboration impact of equal and semantic planning procedures, verbal capacity, and gender on pre-administration educators' exhibition and demeanor to understanding appreciation.

4.3 Summary of findings

la. There was a critical fundamental impact of treatment on students ' Achievement in MWPs. group investigation strategy had the most elevated changed mean score in their post-Achievement in MWPs as against numbered - heads-together and finally by the conventional technique.

1b. Treatment's impact on students ' mentality towards mathematics word problems was huge. The GIS had the most elevated changed mean score in their post mentality towards mathematics word problems against numbered heads-together and finally by the regular methodology.

There was a critical fundamental impact of gender on students ' accomplishment and mentality towards mathematics word problems

3a. There was a huge primary impact of verbal capacity on students' Achievement in MWPs. High verbal capacity students had a superior Achievement in MWPs as against low verbal capacity students .

3b. There was no critical fundamental impact of verbal capacity on students ' mentality towards mathematics word problems.

4. There were no huge collaboration impacts of gender and treatment on students accomplishment and disposition towards mathematics word problems.

5. The cooperation impacts of treatment and verbal ability did not majorly affected students' accomplishment and demeanor in mathematics word problems.

6. There were no critical cooperation impacts of gender and verbal capacity on students' accomplishment in and disposition towards mathematics word problems.

7. There were no critical cooperation impacts of treatment, gender, or verbal capacity on students' accomplishment and disposition towards MWPs.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

The summary of the findings, the conclusion and further studies recommendations are presented in this chapter.

5.1 Summary of the Study

This study examined the impacts of GIS, NHS and conventional method on secondary school students LO in MWPs in Oyo North Senatorial District, Nigeria. The moderating effects of gender and verbal ability were also examined. Seven null hypotheses were formulated and tested at 0.05 level of significance. The frameworks for this research are two theories of learning (social development and social interdependence). The social development theory was based on the idea that social interaction plays a significant role in the development of cognition, while social interdependence theory was based on the idea that accomplishment of one's goal is affected by the actions of other.

The variables in this research include: independent variable at three levels (GIS, NHS, CM), moderator variable (gender: male and female) and verbal ability (low and high), and dependent variable – Student achievement in and attitude towards the problem of mathematical words.

The participants comprised senior secondary schools 11 (SS2) students selected from nine mixed secondary schools in Oyo North Senatorial District, Nigeria.

Nine senior secondary mixed schools from three local government areas were selected randomly from thirteen local government areas of the District. Intact class in each school was randomly assigned to GIS (225), NHS (190) and CM (172) respectively. The contents covered were arithmetical processes (fractions, ratios, percentages, progressions together with their word problems) and algebraic processes (variation, linear equations, simultaneous linear equations, quadratic equations and applications to word problems).

The pretest-posttest non randomized, non-equivalent, control group quasi experimental design was adopted using a 3x2x2 factorial matrix. Seven research instruments were validated with reported reliability indices comprising three response and four stimuli were used to collect data for the study. The treatment lasted twelve weeks. The data collected were analysed by analysis of covariance, estimated marginal mean and Bonferroni post-hoc test. Findings from the study found that GIS and NHS learning strategies have the capacity to improve and develop students positive attitude in and achievement to MWPs. These strategies are also capable in enhancing students thinking skills. It has also been proved by the study that students' are motivated to learn when they are handled by learning strategy that accommodates students' curiosity, interaction and active engagement.

5.2 Educational Implications

This research implication is of great benefit to students, teachers and stakeholders in the field of education. Instruction must be presented in such a way that it will accommodate students' participation, engagement and learner centeredness. The findings have revealed the significance of adoption of innovative strategies for classroom instruction. The strategies adopted in this research had significant effect on students' academic achievement in and attitude to MWPs. This is as a result of the opportunity afforded the students to be an active participant in the learning context. Mathematics content must be contextualized to make maximum benefit of every instructional situation involving the students. This is so because students learn best in context. The students immediate environment must be taken into consideration when sourcing for instructional materials to suit the students nature thereby facilitate students understanding and achievement of learning objectives set by the teacher.

5.3 Conclusion

This research was carried out as one of such efforts to improve the condition of MWPs instruction in schools, thus improving academic achievement and inculcating positive attitude of students to MWPs. To achieve this, this research examined the impacts of GIS and NHS learning strategies on students' academic achievement in and

Attitude to MWPs. The two strategies were very effective. However, the GIS learning strategy was found to be more effective in tackling students' problems of academic achievement in and Attitude to MWPs. Hence, GIS and numbered-head-together-strategies should be used to enhance the learning of MWPs regardless of students' gender and verbal ability.

5.4 Limitation of the Study

The study was limited to GIS and NHS learning strategies on MWPs in secondary schools. The study covered nine public mixed secondary schools in Iseyin, Itesiwaju and Kajola Local Government Areas of Oyo State. Gender and verbal ability was the moderator variable considered among various variables like mental ability, cognitive style, learning style among others that could have effect on the outcome of this study.

The students in nine secondary schools participated in this research which might be too small to make generalisation.

5.5 Recommendations

As a result of the outcome, the study makes the following suggestions:

1. Teachers should adopt GIS and NHS learning strategies in the teaching of mathematics concepts such as MWPs so as to improve students' achievement in and Attitude to MWPs
2. GIS and NHS learning strategies are recommended to enhance the learning outcome.
3. The in-service mathematics teachers should be re-trained on the effective use of group investigation and numbered-heads-together learning strategies by government and other stakeholders in education through seminars, workshops and conferences. This would go a long way in helping them to effectively adopt these strategies in teaching MWPs.
4. Curriculum planners and experts in the field of Mathematics education should advocate for activity based instruction such as GIS and numbered-heads -together learning strategies where by the teachers would serve as facilitators to deepen students' content knowledge

5.6 Contributions to Knowledge

This research has contributed to knowledge in the following ways:

GIS and NHS learning strategies improved students' achievement in and attitude to MWPs. It was found by the study that GIS and numbered-heads- together learning strategies encouraged students' interactions and team work which deepened their understanding of contents. The study established that students' gender and verbal ability do not determine their LO to MWPs. The study found that GIS and NHS learning strategies have the capacity to create classroom activities which enabled the students to own their learning and transform their zones of proximal development.

The study has found that GIS and NHS learning strategies accommodate the view of every student and expect all the students' to contribute for the benefit of the whole class.

5.7 Suggestions for Further Studies

The following suggestions are made for further research as a result of the limitations of this study.

This research can be extended to other concepts not examined.

This research can be replicated in other science subjects such as biology, chemistry, and physics.

More investigations need to be carried out on the two strategies using other moderator variables like cognitive styles, locus of control and mental ability. Replication of this research could be carried out on other dependent variables such as self-efficacy and critical thinking.

This research could be replicated in other geopolitical zones in Nigeria using more States, LGA's schools, students and teachers for generalisations.

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APPENDIX I

INSTRUCTIONAL GUIDE FOR GROUP INVESTIGATION COOPERATIVE LEARNING STRATEGY

STEP 1:	Splitting of learners into groups
Activity (i):	Learners are organised into task oriented group of about five learners in a group which is heterogeneous in term of gender and
Activity (ii):	The members of each group choose a leader for each group
STEP 2:	Splitting of the concept
Activity (i):	The teacher breaks the topic into subtopic and tells the learners to choose subtopic of their own.
Activity (ii):	Learners plan a variety of learning procedures, task and objectives in line with the chosen subtopics.
STEP 3:	Execution of plan by the students.
Activity (i):	Groups carry out the plan formulated in the second step using variety of learning activities and skills.
Activity (ii):	The teacher monitors and provide the assistance if needed.
STEP 4:	Planning of group presentation
Activity (i):	Groups analyse their information. Itemise the main idea of their investigation. Constitute a steering committee to conduct their presentation and plan how to present their findings in a manner
Activity (ii):	Teacher teaches learners presentation skills such as speaking clearly, concisely, capturing audience attention and avoid long
STEP 5:	Presentations by various groups of students
Activity (i):	All the groups make their presentations.
Activity (ii)	The teacher supervises the presentations make necessary corrections.
STEPS:	Evaluation of various groups and learning objectives
Activity (i):	Teacher evaluates the investigation result and presentations. Achievement of groups is assessed.
Activity (ii):	Exercises containing mathematics word problem are given to learners to evaluate the objectives of the lesson
STEP 7:	Summary and Assignment
Activity:	Teacher summarises the lesson and give assignment to the students

109

APPENDIX II

INSTRUCTIONAL GUIDE FOR NUMBERED-HEADS-TOGETHER STRATEGY

STEP 1:	Splitting of learners into groups
Activity:	Learners are divided into small groups comprising about five(5) learners per group which is heterogeneous in terms of gender and academic
STEP 2:	Numbering of learners in various groups
Activity:	Learners in each group are numbered (1,23,4,5).
STEP 3:	Provision of problem/tasks for students
Activity:	The teacher provides the problem/task for the
STEP 4:	learners Solution of problem/task by students
Activity:	Learners assist one another to solve the problem. The group strive to make sure that every member of the group can solve or answer the question given.
STEPS:	Calling of a number at random in various group
Activity (i):	A number at random is called by the Teacher
Activity (ii):	Learners that own the number answer and earn
STEP 6:	Evaluation of learning objectives
Activity (i):	Each group of learners re-assess their performance and change their strategies.
Activity (ii):	Exercises containing mathematics word problem are given to learners to evaluate the learning objectives
STEP 7:	Summary and assignment
Activity:	Teacher summarises the lesson and give assignment

Appendix III

Lesson Plan on GIS: First week

Subject: Mathematics

Class: SS2

Topic: Linear Equation

Lesson duration: 45 minutes

Reference book: comprehensive mathematics for senior secondary school b y D.BAdu. pp: 60-62.

Number of students in the class: 40

Average age of the students: 15 years

Behavioural objectives: By the end of the lesson, students should be able to

(1) Define Linear equation.

(2)Solve linear equation

(3)Transform word problem leading to linear equation

Previous knowledge: Students can solve problems on additive inverse.

Instructional materials: Charts, subject textbook, chalkboard and so on.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, the teacher asks the students the additive inverse of +5.

Step I: The students are instructed to form group of five students each and ensures that the groups are heterogeneous in terms of gender, ethnicity, and academic ability and points out the following subtopics to be covered: meaning of linear equation and example, solution of linear equation transforming word problems into linear equation and its solution

Step II: The teacher designs the task as follows;

Task1: Meaning of linear equation and their examples, mode of solving linear equation using different operations

Task2: Solution of linear equation using different examples

Task3: transforming word problems into the linear equation with examples

Each group of students chooses a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Step III: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate the questioning pattern on their own based on their individual group. They also dispatch to commence their inquiry or investigation.

Step IV: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the mode of presentation to the entire class.

Step V: The teacher selects one student from each group randomly to lead in their group presentation, the students seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follows by group 2 and so on till the last group makes its presentation.

Evaluation: The teacher gives the following questions to students to solve as exercises.

1. A Dad's age quadruples his child. In sixteen years' time, he will be threefold as old. Ascertain the current age of the Dad.
2. In the event that 189 is taken out from five times of a specific number the outcome is equivalent to one portion of the first number. Compute the number.

Step VI: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the correction with them.

Step V11: The whole lesson is summarised by their teacher and gives the students the following question to solve as assignment.

1. Three numbers add up to 29; the subsequent number is four a bigger number than the main number, the third is twofold the first, work out the numbers
2. A Mum is five times as old as the little girl. A decade prior; the Mum was twice as old as the girl. Compute their present ages

Remarks:

2nd week

Subject: Mathematics

Class: SS2

Topic: Simultaneous Equation.

Subtopic: Word problem leading to simultaneous equations.

Lesson duration: 45minutes

Reference book: comprehensive mathematics for senior secondary school b y D.B Adu. pp: 80-81.

Number of students in the class: 40

Average age of the students: 15 years

Behavioural objectives: By the end of the lesson, students should be able to

(1) Define simultaneous equation.

(2) Translate word problem leading to simultaneous equation into mathematical statements correctly.

(3) Solve the translated statements correctly by elimination method

(4) Solve the translated statements correctly by substitution method

(5) Solve the translated statements correctly by graphical method.

(6) Solve the translated statements correctly by matrix method.

Previous knowledge: Students can solve problems on linear equation.

Instructional materials: Graphs, charts, subject textbook, chalkboard and so on.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, one-third of a number added to four-fifth of itself equal to 17. Find the number

Step1: The teacher asks the students to form group of six students each and ensures that the groups are heterogeneous in terms of gender, ethnicity, and academic ability and points out the following subtopics to be covered: translation of word problem leading to simultaneous equation, solving of translated statement by elimination, substitution, graphical, matrix, solving the translated statement by matrix method.

Step II: The teachers design the students' task as follows;

Task1: meaning of simultaneous equation, translation of word problem into mathematical statements by elimination method.

Task2: Interpretation of word problem into mathematical statements and their solutions by substitution.

Task 3: Interpretation of word problem into mathematical statements and their solutions by graphical method

Task 4: Interpretation of word problem into mathematical statements and their solutions by matrix method. Each group of students chooses a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Step III: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. They also dispatch to commence their inquiry or investigation.

Step IV: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the manner of presentation to the entire class.

Step V: Teacher selects one student from each group randomly to lead in their group presentation. The students seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follows by group 2 and so on till the presentation of the last group.

Evaluation: The teacher gives the following questions to students to solve as exercises.

1. The addition of two integer is13, their product equals 40, what are the integers?

2. Two digits number are increased by 12. If the digits are interchanged the total sum of the digits equals 5. Find the number

Step VI: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Conclusion: The whole lesson is summarised by the teacher and give students the following questions to solve as assignment.

1. A number comprises two digits, its addition equals 8.The distinction in the number and the number with the digit exchanged is 54.Find the number.

2. A dad's age is threefold as old as his child. Nine years ago, the dad was four times as old as his child, calculate their current ages.

Remarks:

3rd week

Subject: Mathematics

Class: SS2

Topic: Quadratic Equation

Subtopic: Word problem leading to Quadratic equations.

Lesson duration: 45 minutes

Reference book: MAN Mathematics for senior secondary school 2

Number of student in the class: 40

Average age of the student: 15 years

Behavioural objectives: By the end of the lesson, students should be able to:

(1) Define Quadratic equation.

(2) Translate word problem leading to Quadratic equation into mathematical statements correctly.

(3) Solve the translated statements correctly by factorization method

(4) Solve the translated statements correctly by completing the square method

(5) Solve the translated statements correctly by formula method

(6) Solve the translated statements correctly by graphical method

Previous knowledge: Students can solve problems on linear equation.

Instructional materials: Graphs, charts, subject textbook, chalkboard and so on.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, the teacher asks the students to solve

$3(y+2)=8y + 10$.

Step I: The students are asked to form group of five students each by their teacher and ensures the heterogeneity of the groups as regards gender, ethnicity, and academic ability and points out the following subtopics to be covered: transforming word problem leading to quadratic equation into mathematical statements, solving of transformed statement by

factorization, solving the transformed statement by formula method, solving of the transformed statement by graphical method.

Step II: The teacher designs the task as follows;

Task1: meaning of quadratic equation, solution of quadratic equation by factorization method

Task2: Transforming of word problem to mathematical statement, solving the transformed statement by formula method

Task3: Transforming of word problem to mathematical statement, solution of translated statements by completing the square method.

Task4: Transforming of word problem to mathematical statement, solving of the translated statements by graphical method.

Each group of students choose a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Step III: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. They also dispatch to commence their inquiry or investigation.

Step IV: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the mode of presenting it to the entire class.

Step V: Teacher selects one student from each group randomly to lead in their group presentation, the students' seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follows by group 2 and so on till the last group makes its presentation.

Evaluation: The teacher gives the following questions to students to solve as exercises

1. The addition of two integers is 44.Their product equals 483, calculate the integers.

2. A rectangle length is 2m greater than the breadth. In the event that its area equals $8m^2$.Calculate its breadth

Step VI: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the correction with them.

Conclusion: The whole lesson is summarised by the teacher and gives the students the following problems to solve as assignment.

1. If five times a particular integer is deducted from twice the square of the integer, it is equals 63. Calculate the integer.

2. A girl is one portion of her mum's age. Their product age 10 years ago was 532. Calculate the Mum's age now.

Remarks;

4th week

Subject: Mathematics

Class: SS2

Topic: Arithmetic processes

Subtopic: Proportion

Duration: 45 minutes

Reference book: comprehensive mathematics for senior secondary school b y D.B Adu. pp:24-25.

population of student in the class:

Average age of the students:

Behavioural objectives: By the end of the lesson, students should be able to

1. Define proportion and give examples
2. State forms of proportion with examples
3. Solve problems on direct proportion
4. Solve problems on inverse proportion
5. Solve problems on complex proportion

Previous knowledge: Students can solve problems on sequence and series.

Instructional materials: Charts, subject textbook, chalkboard and so on.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, which of these ratios is greater 16:7 or 17:6?

Step I: The students are instructed to form group of five students each and ensures that the groups are heterogeneous in terms of gender, ethnicity, and academic ability and points out the following subtopics to be covered: Meaning of proportion, forms of

proportion, calculation on direct proportion, calculation on inverse proportion, calculation on complex proportion.

Step II: The teacher designs the students' task as follows

task1: meaning of proportion and forms of proportion with examples

task2: calculation of direct proportion

task3: calculation of inverse proportion

task4: calculate of complex proportion

Each group of students chooses a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Step III: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. They also dispatch to commence their inquiry or investigation.

Step IV: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the mode of presentation to the entire class.

Step V: The teacher selects one student from each group randomly to lead in their group presentation, the student seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follow by group 2 and so on till the last presenter in the last group makes his presentation.

Evaluation: The teacher gives the following questions to students to solve as exercises

1. A man runs 6km journey for 2hours, how long will it take him to run 9km?

2. 9men does a particular job in 28 days

(a) Calculate the number of days for 14 men to complete the job

(b) How many men will it do it in 56days?

Step VI: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Conclusion: The whole lesson is summarised by the teacher and students are given the following problems to solve as assignment.

1. If the speed of a motorist is 80km/h in 5hours and another one is 60km/h in 4hours. Calculate the journey average speed.

2. It takes 48 men to do a particular work in 30 days. Calculate the time it takes 18men to do the work if they work at the same pace.

Remarks:

5th week

Subject: Mathematics

Class: SS2

Topic: Arithmetic processes

Subtopic: Percentages

Duration: 45 minutes

Reference book: comprehensive mathematics for senior secondary school b y D.BAdu. pp:25-28.

Number on roll:

Average age of the students:

Behavioural objectives: By the end of the lesson, students should be able to

1. Define percentage and calculate simple percentage
2. Calculate percentage increase and decrease.
3. Calculate percentage gain and loss.
4. Calculate percentage error.

Prior knowledge: Students can distinguish between numerator and denominator

Instructional materials: Charts, subject textbook, chalkboard and so on.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, what is the numerator and denominator in $\frac{P}{Q}$?

Step I: The students are instructed to form group of five students each and ensures that the groups are heterogeneous in terms of gender, ethnicity, and academic ability and points out the following subtopics to be covered: Meaning of percentage and calculation of simple percentage, calculation of percentage increase and decrease, calculation of percentage gain and loss, calculation of percentage error.

Step II: The teacher designs the students' task as follows

Task1: Meaning of percentages and calculation of simple percentages.

Task2: Calculation of percentage increase and decrease.

Task3: calculation of percentage gain and loss

Task4: calculation of percentage error.

Each group of students chooses a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Step III: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. The students also dispatch to commence their inquiry or investigation.

Step IV: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the mode of presentation to the entire class.

Step V: The teacher selects one student from each group randomly to lead in their group presentation, the students seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follow by group 2 and so on till the last presenter in the last group makes his presentation.

Evaluation: the teacher gives the following questions to students to solve as exercises

1. When the weight of a baby decreases by 16% it becomes 10.5kg. Find what the weight would have been if it increased by 9%

2. A trader bought certain articles at 10 for ₦15.00 and sold them at ₦19.50 per dozen. Find the percentage gain or loss.

3. The length of a wire is 6.35, a student measured it as 6.65, what is the percentage error to 1 decimal place?

Step6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the correction with them.

Conclusion: The whole lesson is summarised by the teacher and students are given the following question to solve as assignment.

1. An article that cost ₦370.00 was sold at loss of 14% what is the selling price?

2. A man's wage increased from ₦6250 to ₦7125 per month.

(a) Find the percentage increase

(b) If the wages are taxed at 12%. Find the increase in tax payable.

3. Find the percentage error in a piece of wood that was measured to be 1.26m whose actual length was 1.24m

Remarks

6th week

Subject: Mathematics

Class: SS2

Topic: Arithmetic processes

Subtopic: Arithmetic progression.

Reference book: Macrae MF et al: New General Mathematics for senior secondary schools pp: 177-183.

Number on roll:

Average age of the students: 15 years

Behavioural objective: By the end of the lesson, students should be able to

1. Define series and sequences and examples
2. Define arithmetic progression and give examples
3. Calculate the nth term of an AP
4. Calculate the sum of an arithmetic progression (AP)
5. Solve problems on an AP

Previous knowledge: Students can solve problems on number line.

Instructional materials: Charts, subject textbook, chalkboard and so on.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, what is the next term in the sets of numbers 1,5,9,…….

Step I: The students are instructed to form group of five students each and ensures that the groups are heterogeneous in terms of gender, ethnicity, and academic ability and points out the following subtopics to be covered: Meaning of series and sequence, meaning of arithmetic progressions, calculation of nth term of an AP, calculation of sum of arithmetic progressions, calculation of an AP

Step II: The teacher designs the student task as follows

Task1: Meaning of series and sequence with examples

Task2: meaning of arithmetic progressions and its calculations.

Task3: Meaning of nth term of an AP and its calculations

Task4: calculation of sum of arithmetic progression (AP)

Each group of students chooses a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Step III: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. The students also dispatch to commence their inquiry or investigation.

Step IV: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesize and collate necessary information obtained and plan the mode of presentation to the entire class.

Step V: The teacher selects one student from each group randomly to lead in their group presentation, the student seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follows by group 2 and so on till the last presenter in the last group presents their group presentation.

Evaluation: The teacher gives the following questions to students to solve as exercises

1. A sequence: 6, 4, 2, ---------- has a common difference of -2.Find its nth term.
2. An AP has an 18^{th} term of 25 with a common difference of 2. Calculate its first term
3. Find the sum of the series; 50+49+48+----------+2+1.

Step VI: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Conclusion: The whole lesson is summarised by the teacher and students are given the following question to solve as assignment.

1. Calculate the next three terms of the sequence; 27, 9, 3, 1, $\frac{1}{3}, \frac{1}{9}$, ----------
2. Find the number of terms in an AP given that its first and last term are a and 37a respectively and that it's common difference is 4a
3. An AP has 15 terms and a common difference of -3. Find it first and last term, if it sum is 120.

Remarks:

7th week

Subject: Mathematics

Class: SS2

Topic: Arithmetic processes

Subtopic: Geometric progression.

Reference book: Macrae MF et al: New General Mathematics for senior secondary schools pp:177-187.

Number on roll: 40

Average age of the students: 15 years

Behavioural objectives: By the end of the lesson, students should be able to

1. Define a geometric progression
2. Calculate the nth term of GP
3. Calculate the sum of GP
4. Calculate the sum to infinity of GP

Previous knowledge: Students can solve problems on sequence and series.

Instructional materials: Charts, subject textbook, chalkboard and so on.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, the students are asked to state the next two terms in the series 1+4+9+16+25+-----

Step1: the teacher asks the students to form group of six students each and ensures that the groups are heterogeneous in terms of gender, ethnicity, and academic ability and points out the following subtopics to be covered: Meaning of a GP, calculation of GP, calculation of sum of GP, calculation of sum to infinity of a GP.

Step II: The teacher designs the students' task as follows

Task1: Meaning of a GP with examples, calculation of common ratio

Task2: Meaning of nth term of a GP and calculations of nth term of a GP

Task3: Calculation of sum of GP

Task4: calculation of sum to infinity of a GP

Each group of students choose a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Step3: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. They also dispatch to commence their inquiry or investigation.

Step IV: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the mode of presentation to the entire class.

Step V: The teacher selects one student from each group randomly to lead in their group presentation, the students' seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follows by group 2 and so on till the last presenter in the last group makes his presentation.

Evaluation: The teacher gives the following questions to students to solve as exercise

1. AGP has its common ratio and 6^{th} term to be 10 and 2000 respectively. Calculate its first term.

2. A GP has its first term and common ratio equals 5 and 2 respectively.Calculate its nth term

3. A GP has 8 terms. Their first and last terms are 0.3 and 38.4. Calculate its sum.

Step VI: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the correction with them.

Conclusion: The whole lesson is summarised by the teacher and the students are given some questions to solve as homework.

1. Calculate the common ratio of A G.P with -7/32 as its 8^{th} term and a first term of 28.

2. Find the number of terms in a GP given that its first term and last terms are $5\frac{1}{3}$k and $\frac{243}{256}$k respectively and that the common ratio is $\frac{3}{4}$

3. Calculate the sum to infinity of the GP $1+\frac{1}{2} + \frac{1}{4} + \ldots\ldots$

Remarks:

Lesson Plan on NHS: Week 1

Subject: Mathematics

Class: S.S 2

Topic: Linear Equation

Subtopic: Word Problem Leading To Linear Equation

Duration: 45 Minutes:

Reference Book: D.B ADU Comprehensive Mathematics For Senior Secondary Schools Pg: 60-62

Behavioural Objective: By the end of the lesson, students should be able to: 1.Translate word problem into linear equation.2. Solve the translated problem mathematically

Previous Knowledge: students can solve problem on linear equation

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example**,** the teacher asks the students to solve $3(y+2) = 8y+10$

Step 1: The learners are grouped into learning groups of about five students in a group, the teacher give them number and then a problem to solve. For example, one third of a number added to four-fifth of itself is equal to it. Calculate the number.

Step 2: The teacher allows the students to put their heads together to solve the problem and interact with one another in their respective groups and ensure that every member in the team can solve the problem.

Step 3: A number at random is called by the teacher; the students bearing the number raise their hands to answer and obtain points for their groups.

Step 4: The students are allowed to re-assess their operation and then change their strategies for enhancement and later proffer solution

Step 5: The teacher gives the students another problem and repeat steps II, III& IV. A dad's age quadruples his child. In the next four years, he will be threefold as the child. Compute their current ages.

Evaluation: The teacher gives the students the following problems to solve as exercise.

1. When 159 is removed out of five times a particular integer, the result equivalent to one portion of the initial integer, calculate the integer.

2. A dad is three times as old as his daughter. In 12 years' time, he will be twice as old. How old is the father now?

Step 6: The teacher allows the students to do the exercise individually mark their notes in the process and finally do the corrections with them.

Step 7: The whole lesson is summarised by the teacher and the students are given some problems to solve as assignment.

1. Four consecutive numbers add up to 90. Calculate the numbers

2. A dad's age quadruples his child. Nine years ago, the dad was four times as old as his child. Calculate their current ages.

Remarks:

2nd Week

Subject: Mathematics

Class: SS 2

Topics: Simultaneous Linear Equation

Subtopic: Word Problem Leading To Simultaneous Equation

Duration: 40 Minutes

Reference Book: Comprehensive Mathematics for Senior Secondary School by D.B ADU

Pg: 80- 81

Behavioural Objective: By the end of the lesson, students should be able to

1. Translate word problem involving simultaneous equation into mathematical statement.

2. Solve the translated statement correctly

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, the teacher asks the students to solve a+ b = 6 a-b = 4

Step 1: The students are grouped by their teacher into learning groups of about five students in a group give them number and then a problem to solve, for example, the addition of two integers is 8 their product equals 15, calculate the integers.

Step 2: The teacher allows the students to put their heads together to solve the problem and interact with one another in their respective group and ensure that every member in each of the team can solve the problem.

Step 3: A number at random is called by the teacher; the students bearing the number raise their hands to respond and obtain points for their groups.

Step 4: The students are allowed by their teacher to re-assess their operation and then change their strategies for enhancement and later proffer solution to the question.

Step 5: The teacher gives the students another problem and repeat steps II, III& IV. for example, A number of two digit is such that four -fold the units digit is 5 more than threefold the ten's digit. When the digits are reversed, the number increased by 9. Calculate the number.

Evaluation: The teacher gives the students the following problems to solve as exercises.

1. The addition of two digits integers equals 13, if their product is 40. Calculate the integers.

2. A two digits number are added by 9. If the digits are interchanged, the addition of the digits equals 5. Calculate the number.

Step 6**:** The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the correction with them.

Step 7: The teacher summarises the whole lesson and gives the students the following as assignment

1. A two digit integer has seven the unit digit more than twofold the unit digit by 8. When the digits are interchanged the integer is reduced by 9, calculate the integer.

A rectangle is 42cm as its perimeter and its area is 68cm2.compute the length of its sides

Remarks:

3rd week

Subject: Mathematics

Class: SS2

Topic: Quadratic Equation

Sub-topic: Word problem leading to Quadratic equation

Duration: 40 Minutes

Reference book: MAN Mathematics for Senior Secondary School (2)

Objective: By the end of the lesson, students should be able to solve word problem on quadratic equation.

Previous knowledge: Students can solve problems on quadratic equation using the formula method

Step 1: The teacher drills the students by asking simple question to refresh their memory. For example; the teacher asks the students to solve the equation:

$x^2 + 6x + 9 = 0$

Step 2: The Teacher leads the students to solve the under listed examples on the chalkboard.

Example 1: The product of two numbers is 40 and their sum is 13. Find the numbers

Solution

Let the numbers be a & b.

$ab = 40$ …….(1)

$a + b = 13$……(2)

from (2) $b = 13 - a$……(3)

put (3) in (1)

$ab = 40$

$a(13-a) = 40$

$13a - b^2 = 40$

$a^2 - 13a + 40 = 0$

$a^2 - 8a - 5a + 40 = 0$

$a(a - 8) - 5(a - 8) = 0$

$(a - 5)(a - 8) = 0$

$a - 5 = 0 \Rightarrow a = 5$. $a - 8 = 0 \Rightarrow a = 8$.

When a =5, b = 13 – a = 13 - 5 = 8. When a = 8, b = 13 – a = 13 – 8 = 5.

Therefore, the two numbers are 5 & 8

Example 2:-A rectangle has its breadth 3cm less than the length. The area is $88cm^2$.Calculate the breadth.

Solution

Let the breadth be b and length be l.

$b = l - 3$

$A = l \times b$

$= l(l - 3) = 88$

$= l^2 - 3l - 88 = 0$

$l^2 - 11l + 8l - 88 = 0$

$l(l - 11) + 8(l - 11) = 0$

$l + 8 = 0$ or $L - 11 = 0$

$l = -8$ or 11

$l = 11$. When $l = 11$, $b = l - 3$, $b = 11 - 3 = 8cm$

Step 3: The students are allowed to copy the note from the chalkboard ask question if any then the teacher give the following questions to solve as exercise

(1)Two numbers add up to 44. If their product is 483, calculate the numbers.

(2) A rectangle has its breadth 2m lesser compared to the length. In the event that the area equals $8m^2$. Calculate the length.

Step 4: The Teacher allows the students to do the exercise individually mark their notes in the process and finally do the correction with them.

Step 5: The whole lesson is summarised by the teacher and allowed the students to ask question if any.

Step 6: The teacher gives the following questions as assignment

(1)Five times a particular integer is removed out of twice the square of the integer, it result to 63. Calculate the integer.

(2) A dad's age is threefold as old as his child. 10 years a while, their age product equals 532; calculate the present age of the dad .

Remarks:

4th week

Class: SS2

No. of students:

Topic: Arithmetic processes

Subtopic: percentages

Duration: 40minutes

Reference Book: Comprehensive mathematics for senior secondary school b y D.B Adu. pp:25-28.

Instructional Materials: Charts, subject textbook, chalkboard and so on.

Behavioural Objective: Toward the finish of the illustration, students ought to have the option to

1. Define percentage and calculate simple percentage
2. Calculate percentage increase and decrease.
3. Calculate percentage gain and loss.
4. Calculate percentage error

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, what is the numerator and denominator in $\frac{P}{Q}$?

Step 1: The teacher asks the students to form a group of five students each which has to be heterogeneous in terms of gender, ethnicity, and academic ability and number themselves. Then lead the students on the meaning of percentage, percentage gain or loss and percentage error then follow them with appropriate examples

A Percentage is another form of ratio. It is a part of one hundred units. It can also be viewed as ratio whose denominator is 100

Percentage gain = $\frac{SP-CP}{CP}$ X 100

Percentage loss = $\frac{CP-SP}{CP}\ X\ 100$

Percentage error = $\frac{actual\ error}{true\ value}\ X\ 100$. For example, a firm produced 3500 article last year, but this year it is 2975 article. Find the percentage decrease in the production.

Step 2: The teacher allows the students to put their heads together to solve the problem in their respective groups, interact with one another and ensures that every member in the team can solve the problem.

Step 3: A number at random is called by the teacher; the students bearing the number raise their hands to respond and obtain points for each of their team.

Step 4: The students are allowed to re-assess their operation and then reviewed their strategies for enhancement. The teacher later solves the problem.

Step 5: The teacher gives the students another problem and repeat steps 2, 3 and 4. For selling an article for ₦750.00, a woman made a profit of 26%. What should be the selling price to make a profit of 34%?

Evaluation: The teacher gives the following problem to solve as exercise.

1. When the weight of a baby decreases by 16% it becomes 10.5kg. Find what the weight would have been if it increased by 9%

2. A trader bought certain articles at 10 for ₦15.00 and sold them at ₦19.50 per dozen. Find the percentage gain or loss.

3. The length of a wire is 6.35. A student measured it as 6.65, what is the percentage error to 1 decimal place?

Step 6: The teacher allows the students to do their exercise individually, marks their notes in the process and finally does the correction with them.

Step 7: The whole lesson is summarised by the teacher and then gives the following question to solve as assignment.

1. An article that cost ₦370.00 was sold at loss of 14% what is the selling price?

2. A man's wage increased from ₦6250 to ₦7125 per month.

(a) Find the percentage increase

(b) If the wages are taxed at 12%. Find the increase in tax payable.

3. Find the percentage error in a piece of wood that was measured to be 1.26m whose actual length was 1.24m

Remarks:

5th week

Subject: Mathematics

Class: SS 2

Topic: Arithmetic processes

Subtopic: proportion

Reference Book: Comprehensive Mathematics for Senior Secondary Schools by D .B Adu. Pg: 24 -25.

Behavioural Objectives: By the end of the lesson, Students should be able to

i. State the meaning of proportion correctly

ii. State different forms of proportion

iii. Solve problems on proportions accurately.

Previous Knowledge: Students can solve problem on ratio before.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, which of this ratio is greater 16:7 or 17:6?

Step 1: The teacher groups the Students into learning group of about Five Students in a group and give them number. Then lead the students on the meaning of proportion and its types and give students the problem to solve. Thus, proportion is a method of showing the relative comparisons of two or more quantities. It normally contains units. There are three types of proportions, namely, Simple or direct , inverse and complex proportions, Direct proportions compares two quantities Such that when one increases or decreases the other one increase or decreases. In inverse proportion as one quantity increases, the other decreases and vice- versa. On the other hand complex proportion involves combination of two or more simple or inverse proportion them or both with more than two quantities.

For example, a car uses 172 litres of fuel for a distance of 2965km. How many litre of fuel will be needed for a distance of 500km?

Step 2: The teacher allows the Students to put their heads together to solve the problem and interact with one another in their respective groups and make sure that everyone can solve the problem.

Step 3: A number at random is called by the teacher. The students bearing the number raise their hands to respond and obtain points for each of their teams.

Step 4: The students are allowed to re-assess their operation and then change their strategies for enhancement. The teacher later solves the problems.

Step 5: The teacher gives the students another problem and repeat Steps 2, 3, and 4. Thus, the erection of a tower takes 24 men to complete in 15 days. Calculate the number of days 9 men will do the work when working at the same pace.

Evaluation: The teacher gives the students the following problems to solve as exercises.

1. A man runs 6km journey for 2 hours how long will it table him to run 9km?
2. If 9 girls can do a particular task in 28 days.

(a) Calculate the time it take for 14 girls to do the same task

(b) How many men will do it in 56 days?

Step 6: The teacher allows the students to do the exercise individually mark their notes in the process and finally do the correction with them.

Step 7: The whole lesson is summarised by the teacher and then gives the following problems as assignment.

1. If a vehicle can drives 80km per hour in 5hour and another 60km per hour in 4hours.Calculate the average speed for the entire journey.
2. If it takes 48 men to do a particular work in 30 days. Calculate the magnitude of days for 18 men to do same work if they work at the same pace.

REMARKS:

6^{th} week

Class: SS2

No. of students:

Topic: Arithmetic processes

Subtopic: AP

Reference Book: Macrae M.F et al ……

No. of students:…….

Average age of students:……

Instructional Materials:……

Behavioural objectives: By the end of the lesson, students should be able to

1. Define series and sequences and examples
2. Define arithmetic progression and give examples
3. Calculate the nth term of an AP
4. Calculate the sum of an arithmetic progression (AP)
5. Solve problems on an AP

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, what is the next term in the sets of numbers 1,5, 9,…….

Step1: The teacher asks the students to form a group of about five students each which has to be heterogeneous in terms of gender, ethnicity, and academic ability and number themselves. Then leads the students on the meaning of series and sequence, AP, Nth term of an AP and sum of an AP then follow it with appropriate examples

A sequence is a rule which will give more terms in the list e.g. 1, 9, 25, 49 … when the terms of a sequence are added the resulting expression is called a series. e.g. 1+2+3+4+…

A sequence in which terms either increase or decrease in equal steps is called an arithmetic progression (AP). The nth term of n arithmetic progression with a as the first term and d as the difference is given by $Un = a + (n - 1)d$

The sum of an AP with a as the first term, n as the number of terms, L as the last term and d as the common difference is given by

$S=x/2\ (a+l)$ & $S=x/2\{2a+(x-1)d$

Example1: Given the AP 9, 12, 15, 18, Find the (a) 8th term (b) nth term.

Step 2: The teacher allows each group to put their heads together to solve the problem and interact with one another in the respective group and make sure that every member in each of the team can solve the problem.

Step 3: A number at random is called by the teacher; students bearing the number raise their hands to respond and obtain points for each of their groups

Step 4: The teacher allows the groups to re-assess their operation and then change their strategies for enhancement and then proffer solution.

Step 5: The teacher gives the students another problem to solve and repeat steps 2, 3 and 4.For example, an AP 16 + 9 + 2 + (-5) + …….. has 20 terms. Calculate its sum

Evaluation:

1. A sequence 6, 4, 2, … has a common difference of -2.Calculate its nth term

2. An AP has its 18^{th} term to be 25 and common difference of 2. Calculate its first term.

3. Find the sum of the series; 50+49+48+----------+2+1.

Step 6: The teacher allows the students to do their exercise individually, mark their notes in the process and finally do the corrections with them.

Step 7: The whole lesson is summarised by the teacher and then gives the following problems to solve assignment.

1. Calculate the next two terms of the sequence; 27, 9, 3, 1, $\frac{1}{3}, \frac{1}{9}$, ----------

2. Find the number of terms in an AP given that its first and last term are a and 37a respectively and that it's common difference is 4a

3. An AP has 15 terms and a common difference of -3. Find it first and last term, if its sum is 120.

Remarks:

7th week

Class: SS2

No. of students:

Topic: Arithmetic processes

Subtopic: GP

References Book: New General Mathematics

No. of students:…….

Average students:……

Instructional Materials:

Behavioural objectives: By the end of the lesson, students should be able to

1. Define a geometric progression
2. Calculate the nth term of GP
3. Calculate the sum of GP
4. Calculate the sum to infinity of GP

Previous Knowledge: Students can solve problem on a sequence and series.

Introduction: The Teacher drills the student with simple question to refresh their memory. For example, what are the next two terms in the series:

1 + 4+ 9 + 16 + 25

Step1: The teacher asks the students to form a group of five students each which has to be heterogeneous in terms of gender, ethnicity, and academic ability and number themselves. Then leads the students on the meaning of GP, Nth term of an GP and sum of an GP and sum to infinity of a GP then follows it with appropriate examples and give the students the problem to solve.

A sequence in which terms either increase or decrease in common ratio is called geometric progression (GP). The nth term of n GP is given by $U_n=ar^{n-1}$, the sum of a GP is given by $S=a + ar^2 + ar^3 + ar^4 + ar^{n-1}$...(1)

$rS= ar + ar^2 + ar^3 + ar^4 + …. + ar^n$ …(2)

Subtract two from one

$S - rS = a - ar^n$

$S(1 – r) = a (1 - r^n)$

$S = \underline{a (1 – r^n)}$ …….. (1)

$1 - r$

Multiply numerator and denominator by -1

$$S = \frac{a(r^n - 1)}{r - 1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

If $r < 1$ (1) is more applicable if $r > 1$ (2) is more applicable. $S_\infty = \frac{a}{1-r}$.Given the geometric progression 5, 10, 20, 40, 80, … Find its (a) 9th (b)nth term

Step 2: The teacher allows each group to put their heads together to solve the problem and interact with one another in their respective group and ensure that every member in the group can solve the problem

Step 3: A number at random is called by the teacher; students with that number raise their hands to respond and obtain points for each of their groups

Step 4: The instructor leaves the various groups to re-assess their performance and reviews their strategies for improvement later the teacher solves the problems.

Step 5: The teacher gives the students another problem to solve and repeat steps 2, 3 and 4 for example, calculate the sum of GP: 2 + 6 + 18 + 54 + …… + 1458.

Evaluation:

1. A GP has its 6^{th} term to be 2000. Find its first term if its common ratio is 10.
2. The first term and common ratio of a GP are 5 and 2 respectively. Calculate its nth term
3. A GP has 8 terms. Its first and last terms are 0.3 and 38.4. What is the sum of the terms of the GP?

Step 6: The teacher allows the students to solve the problem individually, mark their notes in the process and finally do the corrections with them.

Step 7: The whole lesson is summarised by the teacher and then gives the following questions to students to solve as assignment.

1. A GP has its 8^{th} term as $-\frac{7}{32}$ .Calculate its common ratio if it has a first term of 28.
2. Find the number of terms in a GP given that its first term and last terms are $5\frac{1}{3}k$ and $\frac{243}{256}k$ respectively and that the common ratio is $\frac{3}{4}$

3. A GP has its 2^{nd} and 5^{th} terms to be -7 and 56 respectively. Calculate the addition of the first five terms

4. Compute the sum to infinity of the GP $1+\frac{1}{2} + \frac{1}{4} + \ldots\ldots$

Remarks:

Lesson Plan on Conventional Strategy: Week 1

Class: SS2

Topic: Linear equation

Subtopic: Word problem leading to linear equation

Duration: 40 minutes

Reference book: Comprehensive mathematics for senior secondary school. Page: 60-62.

Behavioural Objective: By the end of the lesson, students should be able to solve problems leading to linear equation

Previous Knowledge: Students can solve problem on linear equation before.

Step 1: The teacher drills the students by asking simple question to refresh their memory. For example the teacher asks the student to solve 3(y+3) = 8y+10

Step 2: The teacher leads the students to solve some problems as examples

Example 1: one third of a number added to four – fifth of its self is equal to 17. Find the number.

Solution:

Let the number be x $\frac{1}{3}$ x $\times \frac{4}{5}$x =17

Multiply through by 15

$\frac{1}{3} x \times 15^{5} + \frac{4x}{5} \times 15^{3} = 17 \times 15$

$5x + 12x = 255$

$17x = 255 \qquad x = 15$

Example 2: A dad's age quadruples his child. In the next four years he will be threefold as old .Calculate their current ages

Solution:

Let the ages of the son and the father be a and b respectively

$b = 4a$

$b + 4 = 3(a + 4)$

$b + 4 = 3a + 12$

$4a + 4 = 3a + 12$

$a = 8. \qquad b = 4a = 4 \times 8 = 32$

Step 3: The students are given the opportunity to copy the note from the chalkboard and ask question if any

Step 4: The teacher gives the following questions as exercise

1. When 189 is removed out of five times a particular integer it amounts to one portion of the initial integer. Calculate the integer.

2. A dad's age is threefold as old as his child. In the next 12 years he will be double as old. Calculate the present dad's age

Step 5: The teacher gives the students opportunity to do the exercise in the process and finally do the corrections with them.

Step 6: The teacher summarises the whole lesson and allowed the students to ask question if any.

Step 7: The teacher gives the following questions to solve as assignment

1. A rectangle has 68cm^2 as its area and perimeter of 42cm.Calculate the length of its sides.

2. A two digits integer is such seven times the unit digit is 8 greater than double the tens digit. If the digits are interchanged the integer is decreased by 9, calculate the integer.

Remarks:

2nd week

Class: SS2

Topic: Simultaneous equation

Subtopic: Word problem leading to simultaneous equations

Duration: 45 minutes

Reference book: Comprehensive school by D.B Adu. Page 80-81

Behavioural Objectives: By the end of the lesson, student should be able to:

I Translate word problem leading to simultaneous equation into mathematical statements

ii. Solve the translated statements correctly

Previous knowledge: students can solve problem on simultaneous equation.

Step 1: The teacher drills the students by asking simple question to refresh their memory. For example, the teacher asks the students to solve $x + y = 4, x - y = 2.$

Step 2: The teacher leads the students to solve some questions as example, In the event that two numbers add up to 8 and their product equals 15, calculate the integers

Solution: Let the two numbers be $a\ and\ b$

$a + b = 8 - -1$

$ab = 15 - -2$

$a = 8 - b - -3$

$(8 - b)b = 15$

$8b - b^2 = 15$

$b^2 - 8b + 15 = 0$

$b^2 - 5b - 3b + 15 = 0$

b (b-5)-3(b-5) =0

(b - 5) (b- 3) =0 b - 5 = 0 b = 5

b– 3 = 0 ~~b~~3

Example 2: An integer of two digits is such that threefold the ten's digit is 5 less the quadruple the unit digit. When the digits are interchanged the integer is increased by 9. compute the integer.

Solution: Let the two digits be $x\ and\ y$ such that $x\ is\ ten's\ digit\ and\ y\ is\ unit$.

therefore the number is $10\ x + y$

$4y = 3x + 5$-------- 1

$10x + y = 10y + x + 9$

$10x - x + y - 10y = 9$

$9x - 9y = 9$

$x - y = 1$

$x = y + 1$

4y = 3 (y +1) + 5

4y = 3y + 3+ 5

Y = 8

$x = 8 + 1 = 9$

$10x + y = 10\ (9) + 8 + 98.$

Step 3: The students are given the opportunity to copy the note from the chalkboard and ask question if any.

Step 4: The teacher gives the following questions as exercise

1. Two numbers add up to 13, their product is 40. Calculate the numbers.
2. If 9 is added to two digits number and later interchanged, the addition of the digits equals 5. Calculate the number.

Step 5: The teacher allows the students to do the exercise individually mark their notes in the process and finally do the corrections with them.

Step 6: The Teacher summarises the whole lessons and allowed the students to ask question if any.

Step 7: The Instructor gives some questions to solve as assignment

1. A number contains two digits, its addition is 8. The distinction in the number with the digit reversed is 54.find the number
2. A dad's age is threefold as old as his child. Nine years ago, the dad's age quadruples his child. Calculate their current ages .

Remarks:

3rd week

Class: SSS 2

Topic: Quadratic Equation

Sub-topic: Word problem leading to Quadratic equation

Duration: 40 Mins

Reference book: MAN Mathematics for Senior Secondary School (2)

Learning Objectives: By the end of the lesson, students should be able to solve word problem on quadratic equation.

Previous knowledge: Students can solve problems on quadratic equation using the formula method.

Introduction: The teachers drills the students by asking simple question to refresh their memory, for example, the teacher asks the students to solve $3(y+2) = 8y+10$.

$3(y+2) = 8y+10.$

$3y + 6 = 8y+10.$

$-5y = 4$.

$y = -4/5$.

The concept of word problem leading to quadratic equation will be explored. Interpretation of word problem into mathematical equations and their solutions will be examined.

Step I: The students answered the question asked by the teacher. The Teacher later provides a brief answer.

$x^2 + 6x + 9 = 0$

Step 2: The students are led by their teacher to solve the under listed examples on the chalkboard.

Example 1: The product of two numbers is 40 and their sum is 13. Find the numbers

Solution

Let the numbers be a & b.

$ab = 40$ …….(1)

$a + b = 13$……(2)

from (2) $b = 13 – a$ ……(3)

put (3) in (1)

$ab = 40$

$a(13-a) = 40$

$13a – a^2 = 40$

$a^2 – 13a + 40 = 0$

$a^2 – 8a – 5a + 40 = 0$

$a(a – 8) – 5(a– 8) = 0$

$(a – 5) (a – 8) = 0$

$a – 5 = 0 \Rightarrow a = 5$. $a – 8 = 0 \Rightarrow a = 8$.

When $a=5$, $b= 13 – a = 13 - 5 = 8$. When $a = 8$, $b = 13 – a = 13 – 8 = 5$.

Therefore, the two numbers are 5 & 8

Example 2:- A rectangle has its breadth 3cm less the length. If it has an area of $88cm^2$. Compute the breadth.

Solution

Let the length and breadth of the rectangle be l and b respectively.

$b = l – 3$

A = l x b

= l (l – 3) = 88

= l^2 – 3l – 88 = 0

l^2 – 11l + 8l – 88 = 0

l (l – 11) + 8(l – 11) = 0

l + 8 = 0 or L – 11 = 0

l = -8 or 11

l = 11. When l = 11, b = l – 3, b = 11 – 3 = 8cm

Step 3: The Students seek clarification on some question not cleared to them.

Step 4: The teacher allows the students to copy the note from the chalkboard.

Step 5: The teacher gives the following questions to solve as exercise

(1) Two numbers add up to 44, their product is 483, calculate the numbers

(2)A rectangle has its breadth 2m less than the length. If it has an area of 8m^2.Calculate the breadth.

Step 6: The Teacher allows the students to do the exercise individually mark their notes in the process and finally do the corrections with them.

Step 7: The lesson is summarised and the students are allowed to ask question if any by their teacher, then give the following questions as assignment

(1) If 5 times a particular integer is removed out of twice the square of the integer, it equals 63.What is the integer?

(2) A dad's age is threefold as his child.10 years ago; their ages product was 532, calculate the current age of the dad.

Remarks:

4th week

Class: SS 2

Topic: Arithmetic processes

Sub-topic: Ratio and percentage

Duration: 45 minutes

Reference book: Comprehensive mathematics for senior secondary schools by D.B Adu. Pg. 23-27

Behavioural Objective: By the end of the lesson, students should be able to:

(i) Differentiate ratio and percentage correctly

(ii) Solve word problem involving ratio and percentage.

Previous knowledge: Students can distinguish numerator from denominator

Step I: The Teacher drills the students by asking simple question to refresh their memory for example, what is the numerator and denominator in P/Q?

Step 2: The students are led on the meaning of ratio and percentage by their teacher with appropriate examples. Ratio is a numerical method of comparing two quantities that are of the same type e.g. Marks, length, weight, ages among others.

A percentage is another form of fraction proportion. It is a part of one hundred units. It can also be viewed as ratio whose denominator is 100.

1. The men to women's ratio are 2:5 in a competition. If 40 men are there, compute the numbers of women in the class.

Solution

Let the number of women be n.

$\frac{2}{5} = \frac{40}{n}$

$2n = 5 \times 40 = 200$

$n = 100$

Example 2: A firm produces 3500 articles last years, but this year it is 2975 articles. Find the percentage decrease in the production.

Solution

Last year production: 3500

This year production = 2975

% decreases = $\frac{3500-2975}{3500} \times 100$

= 15%

Step 3: The students are given the opportunity to copy the note from the chalkboard ask question if any then give the following questions to solve as exercise.

1. In preparing a recipe for cake, the flour to sugar ratio is 40:3. Find the amount of flour to 18kg of sugar.

2. A man's wages increased from N6250 to N7125 per month.

(a) Find the percentage increase

(b) If the wages are taxed at 12%, find the increase in tax payable

Step 4: The students are allowed to do the exercise individually mark their notes in the process and finally do the corrections with them.

Step 5: The whole lesson is summarised and the students are allowed to ask question if any by their teacher

Step 6: The Instructor gives some questions to solve as homework

1. The father and a daughter ages have a ratio 8:5. If the daughter's age now is15. What was the father's age 6 years ago?

2. When the weight of a baby decreases by 16%, it becomes 10.5kg. Find what the weight would have been if it increased by 90%.

Remarks:

5th week

Class: SS 2

Topic: Arithmetic processes

Subtopic: Proportions

Duration: 40 minutes

Reference book: Comprehensive mathematics for senior secondary school by D.B Adu. Pg. 24-25

Behavioural Objectives: By the end of the lesson, students should be able to:

(i) State the meaning of proportion correctly

(ii) Solve problems on proportion accurately

Previous knowledge: Students can solve problem on ratio

Step I: The students are drilled by asking simple questions by their teacher to refresh their memory. For example, which of these ratios is greater 6:7 and 17:6?

Step 2: The students are led on the meaning of proportion and its different forms and then follows it with appropriate examples. Proportion is a method of showing the relative comparison of two or more quantities. It normally contains unit. There are three types of proportions, namely simple or direct, inverse and complex proportions. Direct proportion compares two quantities such that when one increases or decreases the other one also

increases or decreases. In inverse proportion, as one quantity increases the other decreases and vice-versa. On the other hand, complex proportion involves combination of two or more simple or inverse proportions or both with more than two quantities.

Example 1: A car uses 172 litres of fuel for a distance of 2965km. How many litres of fuel will be needed for a distance of 500km?

Solution

2965km $\longrightarrow$ 172 litres

1km $\longrightarrow$ $\frac{172}{2965}$ litres

500km $\longrightarrow$ ($\frac{172}{2965}$ x 500)

29.00506

$\sim$ 29litres.

Example 2: The erection of a tower takes as 24man to complete in 15days. How many days will a man take to erect the tower when working at the same rate?

Solution:

24 men completed it in 15days. 1 man complete it in 24 x 15days a man complete it in 24 x 15d

= 40days

Step 3: The students are allowed to copy the note from the chalkboard ask questions if any then give the following questions to solve as exercise.(a) A man runs 6km journey for 2hours. How long will it takes him to run 9km.

(2) 9 man do a particular work in 28days (a) How long will it take 14men to do? (b) How many men will do it in 56 days?

Step 4: The students are allowed to do the exercise individually mark their notes in the process and finally do the corrections with them.

Step 5: The whole lesson is summarised and the students are allowed to ask questions if any by their teacher

Step 6: The teacher gives the following questions to solve as assignment

(1)If a motorist can drives 80km per hour in 5hours and another 60km per hour in 4hours. Find the average speed for the whole journey.

(2) It takes 48men to do a piece of job in 30days.Calculate the days it takes 18men to do the exact job if they work at the same pace.

Remarks:

6th week

Class: SS2

Topic: Arithmetic processes

Subtopic: Arithmetic progression

Duration: 45minutes

References Book: Macrae M.F et al

No of students……..

Average age…….

Behavioural objectives: By the end of the lesson, students should be able to

1. Define series and sequences and examples
2. Define arithmetic progression and give examples
3. Calculate the nth term of an AP
4. Calculate the sum of an arithmetic progression (AP)
5. Solve problems on an AP

Previous Knowledge: Students can solve problem on number line.

Instructional Materials:

Step I: The Teacher drills the students with simple question to refresh their memory. For example, what are the next terms in the set of numbers: 1, 5, 9? Step 2: The students are led on the meaning of series and sequence, arithmetic progression (AP), in the term of an AP and sum of AP then follow it with appropriate examples. A sequence is a rule which will give more terms in the list e.g. 1, 9, 25, 49, ------ when the terms of a sequence are added, the resulting expression is called a series e.g. 1+2+3+4+……

A sequence in which terms either increase or decrease in equal steps is called an arithmetic progression (AP). The nth term of n arithmetic progression with a as the first term and d as the difference is given by $Un = a + (n - 1)d$

The sum of an AP with a as the first term, x as the number of terms, L as the last term and d as the common difference is given by

S=x/2 (a+l) & S=x/2{2a+(x-1)d}

Example1: Given the AP 9, 12, 15, 18, Find the (a) 8th term (b) nth term.

Solution a=9, d=3, n=8

(a) U_8 = a+ (8-1)d = 9 + 7 X 3 =30

(b) U_n = a+ (n-1)d

= 9+(n-1)3

=9 +3n-3= 6+3n

Example2: Calculate the addition of the first 20 terms of AP 16 +9+2+(-5) + ……

Solution: a=16, d=-7, n=20.

S= n/2 {2a + (n-1)d}

=20/2 {2X16+(20-1)-7}

=10(32-133)

=-1010

Step 3: The students are given the opportunity to copy the note from the chalkboard, ask question if any then give the following questions to solve as exercise.

1. A sequence 6, 4, 2, ---------- has a common difference of -2.Find its nth term.

2. An AP has a common difference of 2 with 25 as its 18^{th} term. Calculate its first term

3. Find the sum of the series; 50+49+48+----------+2+1.

Step 4: The students are allowed to do the exercise individually mark their notes in the process and finally do the corrections with them.

Step 5: The whole lesson is summarised and students are allowed to ask question if any by their teacher

Step 6: The teacher gives questions to solve as assignment

1. Calculate the next two terms of the given sequence; 27, 9, 3, 1, $\frac{1}{3}, \frac{1}{9}$, ----------

2. Find the number of terms in an AP given that its first and last term are a and 37a respectively and that it's common difference is 4a

3. An AP has 15 terms and a common difference of -3. Find it first and last term, if its sum is 120.

Remarks:

7^{th} week

Class: SS2

Topic: Arithmetic processes

Subtopic: Geometric progression

Duration: 45 minutes

References Book: New general mathematics for senior secondary school

Macrae M.F et al pp:177-187

No. of students……..

Average Age of student:15 years

Instructional Materials:……

Behavioural objectives: By the end of the lesson, students should be able to

1. Define a geometric progression
2. Calculate the nth term of GP
3. Calculate the sum of GP
4. Calculate the sum to infinity of GP

Previous Knowledge: Students can solve problem on a sequence and series.

Step I: The Teacher drills the students with simple question to refresh their memory. For example, what are the next two terms in the series?

1 + 4+ 9 + 16 + 25 +……?

Step 2: The students are led on the meaning of GP, sum to infinity then give appropriate examples.

A sequence in which terms either increase or decrease in common ratio is called geometric progression (GP). The nth term of n GP is given by $U_n=ar^{n-1}$, the sum of a GP is given by $S=a + ar^2 + ar^3 + ar^4 + ar^{n-1}$...(1)

$rS= ar + ar^2 + ar^3 + ar^4 + …. + ar^n$ …(2)

Subtract two from one

$S - rS = a - ar^n$

$S(1 – r) = a (1 - r^n)$

$$S = \frac{a(1 – r^n)}{1 – r} \text{ …….. (1)}$$

Multiply numerator and denominator by -1

$S = \frac{a(r^n - 1)}{r - 1}$ ……(2)

if r < 1 (1) is more applicable if r > 1 (2) is more applicable. $S_\infty = \frac{a}{1-r}$

Example1: Given the geometric progression 5, 10, 20, 40, 80, … Find its (a) 9th (b)nth term

Solution: a=5, r=2, n=9

(a) $U_9 = ar^{n-1} = 5 \text{ X } 2^{9-1} = 5 \text{ X } 2^8 = 1280$

(b) nth term =? $U_n = ar^{n-1}$

$=5(2^{n-1})$

Example 2: Find the sum of the GP: 2 + 6 + 18 + 54 + … + 1458.

Solution: a =2, r = 6/2 =3

$U_n = ar^{n-1}$

$2X3^{n-1} = 1458$

$3^{n-1}\ 729 = 3^6$

n-1=6 = 7.

$S = \frac{a(r^n - 1)}{r - 1}$

$= \frac{2(3^7 - 1)}{3 - 1}$

$= (2187 - 1) = 2186.$

Example 3:A GP has its sum to infinity equals 60. If its first term is 12, find its second term.

Solution: S_∞=60, a =12, r=?

$S_\infty = \frac{a}{1-r} = \frac{12}{1-r}$

60(1 – r) =12

$1 - r = \frac{12}{60} = \frac{1}{5}$

$r = 1 - \frac{1}{5} = \frac{4}{5}$

Second term = ar = 12 X 4/5 = 9.6

Stage 111: The learners are allowed by their Instructor to copy the note from chalkboard ask question if any then give the following questions to solve as exercise.

1. A GP has its 6^{th} term and common ratio to be 2000 and 10 respectively. Find its first term.
2. A GP has a first term of 5 with 2 as its common ratio. Calculate its nth term.
3. A GP has 8 terms. Its first and last terms are 0.3 and 38.4. Calculate its sum.

Step 4: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Step 5: The whole lesson is summarised and the students are allowed to ask question if any by their teacher

Step 6: The teacher gives some questions to solve as home work.

1. If $-\frac{7}{32}$ is the 8^{th} term of a GP. Calculate its common ratio if it has a first term of 28.
2. Find the number of terms in a GP given that its first term and last terms are $5\frac{1}{3}$k and $\frac{243}{256}$k respectively and that the common ratio is $\frac{3}{4}$
3. The 2nd and 5th terms of a GP are -7 and 56 respectively. Calculate the addition of the first five terms
4. Compute the addition to infinity of a GP $1+\frac{1}{2} + \frac{1}{4} + \ldots$

Remarks:

Appendix IV

Lesson note on GIS: Week 1

Class: SS2

Topic: Linear Equation

Lesson duration: 45 minutes

Reference book: comprehensive mathematics for senior secondary school b y D.B Adu. pp: 60-62.

Average age of the students: 15 years

Learning objectives: By the end of the lesson, students should be able to

(1) Define Linear equation.

(2) Solve linear equation

(3) Transform word problem leading to linear equation

Previous knowledge: Students can solve problems on additive inverse.

Instructional materials: Charts, subject textbook and chalkboard.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, the students are asked the additive inverse of +5 and -5. The teacher then respond by saying: +5 is the additive opposite of -5 while the additive opposite of -5 is +5. In finding the additive inverse positive sign is changed to negative (-) and vice versa. In finding the multiplicative inverse, the given number is inverted, for example, the multiplicative inverse of $\frac{2}{3}$ is$\frac{3}{2}$. The concept of linear equation and its word problem will be explored in this lesson together with the translation of word problem leading to linear equation and its solution. Students attempts to answer the question by giving different opinion then the students are instructed to place themselves into teams of five students which is heterogeneous in terms of ethnicity, gender and academic ability.

Step 1: Student attempts to answer the question by giving different opinion. The teacher points out the following subtopics to be covered: meaning of linear equation and example, transformation of word problems leading to linear equation. Solutions of transformed problem.

Step 2: The teacher designs the task as follows;

Task1: Meaning of linear equation and their examples, mode of solving linear equation using different operations

Task2: Solution of linear equation using different examples

Task3: transforming word problems into the linear equation with examples

Each group of students chooses a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Step 3: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. Students also dispatch to commence their inquiry or investigation.

Step 4: The teacher goes around the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesize and collate necessary information obtained and plan the mode of presentation to the entire class. The teacher teaches the students presentation skill such as speaking concisely and precisely and capturing the audience attention through regular eye contact.

Step 5: The teacher selects one student from each group randomly to lead in their group presentation. The student seat according to their group arrangement presenter number one (group 1) with task 1 commences the presentation follows by group 2 and so on till the last group makes its presentation. The teacher supervises the presentations and makes necessary correction.

Evaluation: The teacher gives the following questions to students to solve as exercises.

1. A mum is three fold as old as her child. In the next twelve years; she will be double as old. Calculate the current age of the mum.

2. When 189 are removed out of five times a particular integer it is equivalent to one portion of the initial integer. Calculate the integer.

Step 6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the correction with them.

Step 7: The whole lesson is summarised and the students are given the following questions to solve as assignment by their teacher.

1. Three numbers add up to 36; the second integer is three more than the initial number, and the last is twice the initial, calculate the integers.

2. A mum is three fold as old as the child. Nine years a while the mum was four fold as old as the child. Calculate the mum's age now.

Remarks:

Week 2

Class: SS2

Topic: Simultaneous Equation.

Subtopic: Word problem leading to simultaneous equations.

Lesson duration: 45 minutes

Reference book: comprehensive mathematics for senior secondary school b y D.B Adu. pp: 80-81.

Average age of the students:

Learning objectives: By the end of the lesson, students should be able to

(1) Define simultaneous equation.

(2) Translate word problem leading to simultaneous equation into mathematical statements correctly.

(3) Solve the translated statements correctly by elimination method

(4) Solve the translated statements correctly by substitution method

(5) Solve the translated statements correctly by graphical method.

(6) Solve the translated statements correctly by matrix method.

Previous knowledge: Students can solve problems on linear equation.

Instructional materials: Graphs, charts, subject textbook, and chalkboard

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, one-third of a number added to four-fifth of itself equal to 17. What is the number? $\frac{1}{3}x + \frac{4x}{5} = 17$

$\frac{1}{3x}x15 + \frac{4x}{5}x15 = 17x15$

$5x + 12x = 255$

$17x = 255$

$X=15$

The interpretation of word problem leading to simultaneous equation will be explored. The solving of transformed problems by elimination, substitution and graphical method will also be examined.

Presentation: The various groups that were created in week 1 are retained.

Stage 1: The teacher breaks the topic into subtopic and points out the following subtopics to be covered: Interpretation of word problem leading to simultaneous equation into mathematical equation and its solution by elimination method. Interpretations of word problems to simultaneous equations and their solutions by substitution method. Interpretations of word problems to simultaneous equations and its solution by graphical method.

Stage 2: The teacher designs the students' task as follows:

Task1: Translation of word problem into mathematical equation and its solution by elimination method.

Task2: Translation of word problems into mathematical equation and its solution by substitution method

Task 3: Translation of word problem into mathematical equation and its solution by graphical method

Task 4: Translation of word problem into mathematical equation and its solution by matrix method. Each group of students chooses a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Stage 3: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. The students also dispatch to commence their inquiry or investigation.

Stage 4: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesize and collate necessary information obtained and plan the manner of presentation to the entire class. The teacher teaches the students the presentation skills such as speaking concisely, precisely and capturing of audience attention by maintaining regular eye contact.

Stage 5: Teacher selects one student from each group randomly to lead in their group presentation. The students seat according to their group arrangement. Presenter number

one (group1) with task 1 commences the presentation follows by group 2 and so on till the presentation of the last group. The teacher supervises the presentations and makes necessary corrections.

Evaluation: The teacher gives the following questions to students to solve as exercises.

1. Two numbers add up to 13, their product is 40, calculate the numbers

2. A number comprises two digits. When the digits are added to 9 and then interchanged the addition of the digits of the number equals 5. Calculate the integer.

Step 6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Step 7: The whole lesson is summarised and the students are given the following questions to solve as assignment by their teacher.

1. A number contains two digits, their addition equals 8 and the distinction in the number and the number with the digit exchanged is 54. Compute the number.

2. A mum is three fold as old as her child. Nine years a while back, the mum was four fold as old as her child; compute the current age of the mum.

Remarks:

Week 3

Class: SS2

Topic: Quadratic Equation

Subtopic: Word problem leading to Quadratic equations.

Lesson duration: 40minutes

Reference book: MAN Mathematics for senior secondary school 2

Average age of the students:15 years

Learning objectives: By the end of the lesson, students should be able to :

(1) Define Quadratic equation.

(2) Translate word problem leading to Quadratic equation into mathematical statements correctly.

(3) Solve the translated statements correctly by factorization method

(4) Solve the translated statements correctly by finishing the square method

(5) Solve the translated statements correctly by formula method

(6) Solve the translated statements correctly by graphical method

Previous knowledge: Students can solve problems on linear equation.

Instructional materials: Graphs, charts, subject textbook, and chalkboard .

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, the teacher asks the students to solve

$3(y+2)=8y + 10.$

$3y+6=8y+10$

$6-10=8y-3y$

$-4=5y$

$Y=-4/5.$

The concept of word problem leading to quadratic equation will be explored. Calculations of transformed equations by factorisation formula and completing the square method will also be examined.

Presentation: The various groups that were created in week one are retained.

Stage 1: The Instructor breaks the topic into subtopics and points out the following subtopics to be covered: transforming word problem leading to quadratic equation into mathematical statements, solving of transformed statement by factorization, solving the

transformed statement by formula method, solving of the transformed statement by completing the square method.

Stage 2: The teacher designs the task as follows;

Task1: meaning of quadratic equation, solution of quadratic equation by factorization method

Task2: Transforming of word problem to mathematical statement, solving the transformed statement by formula method

Task3: Transforming of word problem to mathematical statement, solution of translated statements by completing the square method.

Task4: Transforming of word problem to mathematical statement, solving of the translated statements by graphical method.

Each group of students choose a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Stage3: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. The students also dispatch to commence their inquiry or investigation.

Stage 4: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the mode of presenting it to the entire class. The teacher teaches the students the presentation skills such as speaking concisely, precisely and capturing of audience attention through regular maintenance of eye contact.

Stage 5: Teacher selects one student from each group randomly to lead in their group presentation, the students' seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follows by group 2 and so on till the last group makes its presentation. The teacher supervises the presentation and makes necessary corrections.

Evaluation: The teacher gives the following questions to students to solve as exercises

1. The addition of two numbers is 44 and their product is 483, calculate the numbers

2. A rectangle has its length 2m greater than the breadth, if its area equals $8m^2$. Calculate the breadth

Step 6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the correction with them.

Step 7: The whole lesson is summarised and the students are given the questions to solve as assignment.

1. If five times a particular integer is removed from twice the square of the integer, it is equal to 63. Calculate the integer.

2. The dad's age is twofold his child.10 years a while back, 532 was the product of their ages. Calculate the current age of the dad

Remarks:

Week 4

Class: SS2

Topic: Arithmetic processes

Subtopic: Proportion

Duration: 40 minutes

Reference book: comprehensive mathematics for senior secondary school b y D.BAdu. pp:24-25.

Average age of the students:15 years

Learning objectives: By the end of the lesson, students should be able to

1. Define proportion and give examples
2. State forms of proportion with examples
3. Solve problems on direct proportion
4. Solve problems on inverse proportion
5. Solve problems on complex proportion

Previous knowledge: Students can solve problems on sequence and series.

Instructional materials: Charts, subject textbook, and chalkboard

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, which of these ratios is greater 16:7 or 17:6?

17:6 is greater. The concept of direct inverse and complex proportion will be explored.

Presentation: The various groups that were created in week1 are retained.

Stage 1: The Instructor breaks the topic into subtopics and points out the following subtopics to be covered: Meaning of proportion, forms of proportion, calculation on direct proportion, calculation on inverse proportion, calculation on complex proportion.

Step 2: The teacher designs the students' task as follows

task1: meaning of proportion and forms of proportion with examples

task2: calculation of direct proportion

task3: calculation of inverse proportion

task4: calculate of complex proportion

Each group of students chooses a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Step 3: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. The students also dispatch to commence their inquiry or investigation.

Step 4: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the mode of presentation to the entire class. The teacher teaches the students the presentation skills such as speaking concisely and precisely and capturing of audience attention through regular maintenance of eye contact.

Step 5: The teacher selects one student from each group randomly to lead in their group presentation, the student seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follow by group 2 and so on till the last presenter in the last group makes his presentation. The teacher supervises the presentations and makes necessary corrections

Evaluation: The teacher gives the following questions to students to solve as exercises

1. A man runs 6km journey for 2hours, how long will it take him to run 9km?

2. If 9 men can do a particular job in 28 days

(a) Calculate the days it takes 14 men to do the work

(b) Calculate the number of men that will it do it in 56days

Step 6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Step 7: The whole lesson is summarised by their teacher and gives the students the following question to solve as assignment.

1. If a car drives 80km per hour in 5hours and another 60km per hour in 4hours. Calculate the average speed for the journey.

2. It takes 48 men to do a particular work in 30 days. Calculate the number of days for 18men to do the same job if they work at the same pace.

Remarks:

Week 5

Class: SS2

Topic: Arithmetic processes

Subtopic: Percentages

Duration: 40 minutes

Reference book: comprehensive mathematics for senior secondary school b y D.BAdu. pp:25-28.

Average age of the students:15 years

Learning objectives: By the end of the lesson, students should be able to

1. Define percentage and calculate simple percentage
2. Calculate percentage increase and decrease.
3. Calculate percentage gain and loss.
4. Calculate percentage error.

Prior knowledge: Students can distinguish between numerator and denominator

Instructional materials: Charts, subject textbook, and chalkboard

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, what is the denominator and numerator in $\frac{P}{Q}$?

The numerator is p while the denominator is q. The concept of percentage increase and decrease, gain and loss as well as percentage error will be explored in this lesson.

Presentation: The various groups that were created in week 1are retained.

Stage1: The teacher breaks the topic into subtopics and points out the following subtopics to be covered: Meaning of percentage and calculation of simple percentage, calculation

of percentage increase and decrease, calculation of percentage gain and loss, calculation of percentage error.

Stage 2: The teacher designs the students' task as follows

Task1: Meaning of percentages and calculation of simple percentages.

Task2: Calculation of percentage increase and decrease.

Task3: calculation of percentage gain and loss

Task4: calculation of percentage error.

Each group of students chooses a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Stage 3: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. The students also dispatch to commence their inquiry or investigation.

Stage 4: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the mode of presentation to the entire class. The teacher teaches the students presentation skills such as speaking concisely, precisely and capturing of audience attention through regular maintenance of eye contact.

Stage 5: The teacher selects one student from each group randomly to lead in their group presentation, the student seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follow by group 2 and so on till the last presenter in the last group makes his presentation. The teacher supervises the presentation and makes necessary corrections.

Evaluation: the teacher gives the following questions to students to solve as exercise

1. When the weight of a baby decreases by 16% it becomes 10.5kg. Find what the weight would have been if it increased by 9%

2. A trader bought certain articles at 10 for ₦15.00 and sold them at ₦19.50 per dozen. Find the percentage gain or loss.

3. The length of a wire is 6.35, a student measured it as 6.65, what is the percentage error to 1 decimal place?

Stage 6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the correction with them.

Stage 7: The whole lesson is summarised by their teacher and gives the students the following questions to solve as assignment.

1. An article that cost ₦370.00 was sold at loss of 14% what is the selling price?

2. A man's wage increased from ₦6250 to ₦7125 per month.

(a) Find the percentage increase

(b) If the wages are taxed at 12%. Find the increase in tax payable.

3. Find the percentage error in a piece of wood that was measured to be 1.26m whose actual length was 1.24m

Remarks:

Week 6

Class: SS2

Topic: Arithmetic processes

Subtopic: Arithmetic progression.

Reference book: Macrae MF et al: New General Mathematics for senior secondary schools pp: 177-183.

Average age of the students:15 years

Learning objectives: By the end of the lesson, students should be able to

1. Define series and sequences and examples
2. Define arithmetic progression and give examples
3. Calculate the nth term of an AP
4. Calculate the sum of an arithmetic progression (AP)
5. Solve problems on an AP

Previous knowledge: Students can solve problems on number line.

Instructional materials: Charts, subject textbook, and chalkboard

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, what is the next term in the sets of numbers 1,5,9,…….? The teacher answers the question after the response of the students. The next term of

1,5,9 is 13.The concept of nth term and sum will be explored. Also, solution of different problems on an A.P will also be examined.

Presentation: The various groups earlier created in week 1 are retained.

Stage 1: The teacher breaks the topic into subtopics and points out the following subtopics to be covered: Meaning of series and sequence, meaning of arithmetic progressions, calculation of nth term of an AP, calculation of sum of arithmetic progressions, calculation of an AP

Stage 2: The teacher designs the student task as follows

Task1: Meaning of series and sequence with examples

Task2: meaning of arithmetic progressions and its calculations.

Task3: Meaning of nth term of an AP and its calculations

Task4: calculation of sum of arithmetic progression (AP)

Each group of students chooses a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Stage 3: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. The students also dispatch to commence their inquiry or investigation.

Stage 4: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the mode of presentation to the entire class. The teacher teaches the students presentation skills such as speaking clearly and concisely and capturing of audience attention through regular eye contact.

Stage 5: The teacher selects one student from each group randomly to lead in their group presentation, the student seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follows by group 2 and so on till the last presenter in the last group presents their group presentation. The teacher supervises the presentation and makes necessary correction

Evaluation: The teacher gives the following questions to students to solve as exercises

1. A sequence 6, 4, 2, ---------- has a common difference of -2.calculate its nth term.

2. An AP has its 18^{th} term to be 25 and the common difference of 2 Calculate its first term.

3. Calculate the sum of the series; 50+49+48+----------+2+1.

Stage 6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Stage 7: The whole lesson is summarised by their teacher and gives the students the following questions to solve as assignment.

1. Calculate the next three terms of the sequence; 27, 9, 3, 1, $\frac{1}{3}, \frac{1}{9}$, ----------

2. Find the number of terms in an AP given that its first and last term are a and 37a respectively and that it's common difference is 4a

3. An AP has 15 terms and a common difference of -3. Find it first and last term, if its sum is 120.

Remarks:

Week7

Class: SS2

Topic: Arithmetic processes

Subtopic: Geometric progression.

Reference book: Macrae MF et al: New General Mathematics for senior secondary schools pp:177-187.

Average age of the students:15 yrs

Learning objectives: By the end of the lesson, students should be able to

1. Define a geometric progression
2. Calculate the nth term of GP
3. Calculate the sum of GP
4. Calculate the sum to infinity of GP

Previous knowledge: Students can solve problems on sequence and series.

Instructional materials: Charts, subject textbook, and chalkboard

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, the students are asked by their teacher to state the next two terms in the series 1+4+9+16+25+---- The teacher answers the question after the response of

the students. the next two terms of the series are:36 and 49.The concept of nth term and sum of a GP will be explored. also, calculation of common ratio and sum to infinity will also be treated.

Presentation: The various groups earlier created in week 1are retained.

Step1: The teacher breaks the topic into subtopics and points out the following subtopics to be covered: Meaning of a GP, calculation of GP, calculation of sum of GP, calculation of sum to infinity of a GP.

Step 2: The teacher designs the students' task as follows

Task1: Meaning of a GP with examples, calculation of common ratio

Task2: Meaning of nth term of a GP and calculations of nth term of a GP

Task3: Calculation of sum of GP

Task4: calculation of sum to infinity of a GP

Each group of students choose a task. Group 1 for task 1, group 2 for task 2, group 3 for task 3 and so on.

Step3: The teacher gives already prepared material such as hand out to students to read and equally asks them to read any textbook on mathematics that contains the topics or task given. The students formulate their questioning pattern based on their different group. The students also dispatch to commence their inquiry or investigation.

Step 4: The teacher goes round the group to observe and make input if necessary. The students reassembled in their various group to analyse, synthesise and collate necessary information obtained and plan the mode of presentation to the entire class. The teacher teaches the students presentation skills such as speaking clearly, precisely and concisely.

Step 5: The teacher selects one student from each group randomly to lead in their group presentation, the students' seat according to their group arrangement. Presenter number one (group1) with task 1 commences the presentation follows by group 2 and so on till the last presenter in the last group makes his presentation. The teacher supervises the presentation and makes necessary corrections.

Evaluation: The teacher gives the following questions to students to solve as exercise

1. A GP has its 6^{th} term to be 2000. Calculate its first term if its common ratio is 10.
2. A GP has its first term as 5 and its common ratio as 2.Calculate its nth term.

3. A GP has 8 terms. Its first and last terms are 0.3 and 38.4. Calculate the sum of the terms of

Step 6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the correction with them.

Step 7: The whole lesson is summarised by their teacher and gives the students the following questions to solve as assignment.

1. If $-\frac{7}{32}$ is the 8^{th} term of a GP. Calculate its common ratio if it has a first term of 28.

2. find the number of terms in a GP given that its first term and last terms are $5\frac{1}{3}$k and $\frac{243}{256}$k respectively and that the common ratio is $\frac{3}{4}$

3. The 2nd and 5th terms of a GP are -7 and 56 respectively. Calculate its addition of the first five terms

4. Compute the addition to infinity of the GP $1+\frac{1}{2} + \frac{1}{4} + \ldots\ldots$

Remarks:

Lesson note on numbered heads together strategy: Week1

Class: S.S 2

Topic: Linear Equation

Subtopic: Word Problem Leading To Linear Equation

Duration: 40 Minutes:

Reference Book: D.B ADU Comprehensive Mathematics For Senior Secondary Schools Pg: 60-62

Learning Objectives: By the end of the lesson, students should be able to:1. Translate word problem into linear equation.2. Solve the translated problem mathematically

Previous Knowledge: students can solve problem on linear equation

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example**,** what are the additive inverses of +5 and -5?

+5 is the additive opposite of -5 while the additive opposite of -5 is +5.In finding the additive inverse positive sign (+) is changed to negative sign (-) and vice versa. In finding the multiplicative inverse, the given number is inverted. For example the multiplicative inverse of 2/3 is 3/2 . The concept of Linear equation and its word problem will be explored in this lesson. Interpretation of word problem leading to linear equation and its solution will be examined.

Step 1: The students are put into learning groups of about five students in a group by their teacher give them number and then a problem to solve. For example, one third of a number added to four-fifth of itself is equal to it. Find the number.

Step 2: The teacher allows the students to put their heads together to solve the problem and interact with one another in their respective groups and make sure that everyone in each of the team can solve the problem. The teacher goes round the groups and makes input if necessary

Step 3: A number at random is called by the teacher; students bearing the number raise their hands to answer and obtain points for their groups.

Step 4: The teacher allows the students to re-assess their operation and also change their strategies for enhancement and later solve the problem.

Step 5: The teacher gives the students another problem and repeat steps 2, 3 and 4.A dad is fourfold as old as his child. In the next four years he will be threefold as old. Calculate their current ages.

Evaluation: The teacher gives the students the following problems to solve as exercise.

1. When 159 is removed out of five times a particular integer, it is equivalent to one – portion of the initial integer, calculate the integer.

2. A dad is threefold as old as his child. In the next 12 years, he will be twofold as old. Calculate the present age of the dad .

Step 6: The teacher allows the students to do the exercise individually mark their notes in the process and finally do the corrections with them.

Step 7: The whole lesson is summarised by their teacher and then gives the students the following questions to solve as assignment.

1. Four consecutive numbers add up to 90. Calculate the numbers

2. A dad is threefold as old as his child. Nine years a while, the father was fourfold as old as his child. Calculate their current ages.

Remarks:

Week 2

Class: SS 2

Topics: Simultaneous Linear Equation

Subtopic: Word Problem Leading To Simultaneous Equation

Duration: 40 Minutes

Reference Book: Comprehensive Mathematics for Senior Secondary School by D.B ADU

Pg: 80- 81

Learning Objectives: By the end of the lesson, students should be able to

1. Translate word problem involving simultaneous equation into mathematical statement.

2. Solve the translated statement correctly

Previous knowledge: students can solve problem on linear equation.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, the teacher asks the students to solve 1/3x + 4/5x = 17. 1/3x X 15 +4x/5 X 15 =17 X 15. 5x + 12x =255. 17x = 255. X = 15.

The interpretation of word problem leading to simultaneous equation will be explored in this lesson. The solution of the transformed problem will also be examined.

Step 1: The students are put into learning groups of about five students in a group and have them numbered and then gives the students a problem, for example, the addition of two certain integers equals 8 their product equals 15, calculate the initial integers.

Step 2: The teacher allows the students to put their heads together to solve the problem and interact with one another in their respective group and ensure that every member in each of the team can solve the problem.

Step 3: A number at random is called by the teacher; students bearing the number raise their hands to respond and obtain points for each of their groups

Step 4: The students are allowed by their teacher to re-assess their operation and also change their strategies for enhancement and later solve the problem for the students.

Step 5: The teacher gives the students another problem and repeat steps 2, 3, and 4. For example, A number contains two digits with fourfold the units digit is 5 greater than thrice the ten's digit. In the event that the digits are exchanged, the number moved by 9. Calculate the initial number.

Evaluation: The teacher gives the students the following problems to solve as exercises.

1. The addition of two integers equals 13, their multiple is 40. Calculate the integers.

2. A number contains two digits increased by 9 .when the digits are interchanged. The addition of the digits equals 5. Calculate the integer.

Step 6**:** The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Step 7: The Instructor summarises the whole lesson and gives the students the following as assignment

1. A number contains two digits with twice the tens digit is 8 less than seven times the unit digit. When the digits are interchanged the number is decreased by 9, calculate the number

2. A rectangle has its area to be 68cm2 while its perimeter is 42cm. Calculate the length of its sides

Remarks:

Week 3

Class: SS2

Topics: Quadratic equation

Subtopic: word problem leading to quadratic equation

Reference book: MAN Mathematics for Senior Secondary Schools

Learning Objectives: By the end of the lesson, students should be able to: 1.Transform word problem to Quadratic equation 2.Solve the translated problem

Previous knowledge: Students can solve problem on linear equation

Introduction: The teachers drills the students by asking simple question to refresh their memory, for example, the teacher asks the students to solve 3(y +2) = 8y +10.

3(y+2) = 8y +10.

3y + 6 =8y+10.

-5y = 4.

y = -4/5.

The concept of word problem leading to quadratic equation will be explored. Interpretation of word problem into mathematical equations and their solutions will be examined.

Step I: The students are put into learning groups of about five students in a group and have them numbered and then give the student problem to solve for example the product of two numbers is 40 and their sum is 13. Find the numbers.

Step 2: The teacher allows each group to put their heads together to solve the problem and interact with one another in their respective groups and ensure that every member in each of the team can solve the problem.

Step 3: A number at random is called by the teacher; students with that number raise their hands to respond and obtain points for their teams

Step 4: The teacher allows `the group to re-assess their operation and also change their strategies for enhancement and proffer the solution.

Step 5: The teacher gives the students another problem to solve and repeat steps 2,3 and 4 . For example, the length of a rectangle is 3cm greater than the breadth. If its area is 88cm2. Find the breadth.

Evaluation: The teacher gives the following problems to students as exercises.

1. When two certain numbers are added the result is 44.If the product of the numbers is 483, calculate the numbers

2. The length of a rectangle is 2m greater than the length. If the area equals 8m2. Calculate its breadth.

Step 6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Step 7: The teacher gives the students the following problems to solve as assignment.

1. If 5 times a particular integer is removed out of twice the square of the integer, it equals 63. Calculate the integer

2. A dad's age is twofold his child.10 years a while back, their age product was 532.Calculate the current age of the dad.

Remarks**:**

Week 4

Class: SS 2

Topic: Arithmetic processes

Subtopic: proportion

Reference Book: Comprehensive Mathematics for Senior Secondary Schools by D .B A D. U . Pg: 24 -25.

Social targets: By the end of the lesson, Students should be able to

i. State the meaning of proportion correctly

ii. State different forms of proportion

iii. Solve problems on proportions accurately.

Previous Knowledge: Students can solve problem on ratio.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, which of this ratio is greater 16:7 or 7:16?

17:6 is greater. The concept of direct, inverse, and complex proportion will be examined. The calculations of different types of proportions will also be explored.

Step1 : The teacher groups the Students into learning group of about Five Students in a group; number themselves and lead the students on the meaning of proportion and its types and give students the problem to solve. Thus, proportion is a method of showing the relative comparisons of two or more quantities. It normally contains units. There are three types of proportions, namely, Simple or direct , inverse and complex proportions, Direct proportions compares two quantities Such that when one increases or decreases the other one increase or decreases. In inverse proportion as one quantity increases, the other decreases and vice- versa. On the other hand complex proportion involves combination of two or more simple or inverse proportion them or both with more than two quantities.

For example, a car uses 172 litres of fuel for a distance of 2965km. How many litre of fuel will be needed for a distance of 500km?

Step 2: The teacher allows the Students to put their heads together to solve the problem and interact with one another in their respective groups and ensure that every member can solve the problem.

Step 3: A number at random is called by the teacher. The students bearing the number raise their hands to respond and obtain points for each of their groups.

Step 4: The students are allowed by their teacher to re-assess their operation and also change their strategies for enhancement. The teacher later solves the problems.

Step 5: The teacher gives the students another problems and repeat Steps 2, 3, 4. Thus, the erection of a tower takes 24 men to complete in 15 days. Calculate the number of days 9 men will take to erect the tower when working at the same pace

Evaluation: The teacher gives the students the following problems to solve as exercises.

1. A man runs 6km journey for 2 hours. Find the time it will take him to run 9km
2. 9 girls can do a particular piece of work for 28 days.

(a)Calculate the time it will take 14 men to do the same work

(b) How many men will do it in 56 days?

Step 6: The teacher allows the students to do the exercise individually mark their notes in the process and finally do the correction with them.

Step 7: The whole lesson is summarised by their teacher and gives the following problems as assignment.

1. If a car drives 80km per hour in 5hour and another 60km per hour in 4hours.Compute the average velocity for the entire journey.

2. It requires 48 girls to do a particular job for 30 days. Calculate the number of days it will take 18 girls to do same job if they work at the same pace.

Remarks:

Week 5

Class: SS2

No. of students:

Topic: Arithmetic processes

Subtopic: percentages

Duration: 45 minutes

Reference Book: Comprehensive mathematics for senior secondary school b y D.B Adu. pp:25-28.

Instructional Materials: Charts, subject textbook, chalkboard and so on.

Learning Objectives: Toward the finish of the lesson, students will be able to

1. Define percentage and calculate simple percentage
2. Calculate percentage increase and decrease.
3. Calculate percentage gain and loss.
4. Calculate percentage error

Previous knowledge: students can distinguish between numerator and denominator

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, what is the denominator and numerator in $\frac{P}{Q}$?

The numerator is p, while the denominator is q. The concept of percentage increase and decrease, gain and loss as well as percentage error will be explored; also their interpretations into mathematical statements and solutions will also be examined.

Step 1: The teacher asks the students to form a group of five students each which has to be heterogeneous in terms of gender, ethnicity, and academic ability and have themselves numbered Then lead the students on the meaning of percentage, percentage gain or loss and percentages error then follow them with appropriate examples

A Percentage is another form of ratio. It is a part of one hundred units. It can also be viewed as ratio whose denominator is 100

Percentage gain $=\frac{SP-CP}{CP}$ X 100

Percentage loss = $\frac{CP-SP}{CP}\ X\ 100$

Percentage error = $\frac{actual\ error}{true\ value}\ X\ 100$. For example, a firm produced 3500 article last year, but this year it is 2975 article. Find the percentage decrease in the production.

Step 2: The teacher allows the students to put their heads together to solve the problem in their respective groups, interact with one another and ensures that every member in the team can solve the problem.

Step 3: A number at random is called by the teacher; the students with that number raise their hands to respond and obtain points for each of their team.

Step 4: The students are allowed by their teacher to re-assess their performance and also change their strategies for enhancement. The teacher later solves the problem.

Step 5: The teacher gives the students another problem and repeat steps 2, 3, and 4. For selling an article for ₦750.00, a woman made a profit of 26%. What should be the selling price to make a profit of 34%?

Evaluation: The teacher gives the following problem to solve as exercise.

1. When the weight of a baby decreases by 16% it becomes 10.5kg. Find what the weight would have been if it increased by 9%

2. A trader bought certain articles at 10 for ₦15.00 and sold them at ₦19.50 per dozen. Find the percentage gain or loss.

3. The length of a wire is 6.35. A student measured it as 6.65, what is the percentage error to 1 decimal place?

Step 6: The teacher allows the students to do their exercise individually, marks their notes in the process and finally do the corrections with them.

Step 7: The whole lesson is summarised by their teacher and gives the following question to solve as assignment.

1. An article that cost ₦370.00 was sold at loss of 14% what is the selling price?

2. A man's wage increased from ₦6250 to ₦7125 per month.

(a) Find the percentage increase

(b) If the wages are taxed at 12%. Find the increase in tax payable.

3. Find the percentage error in a piece of wood that was measured to be 1.26m whose actual length was 1.24m

Remarks:

Week 6

Class: SS2

No. of students:

Topic: Arithmetic processes

Subtopic: Arithmetic progression

References Book: Macrae M.F et al ……

No. of students: 45

Average age of students:15 years

Instructional Materials:……

Learning objectives: By the end of the lesson, students should be able to

1. Define series and sequences and examples
2. Define arithmetic progression and give examples
3. Calculate the nth term of an AP
4. Calculate the sum of an arithmetic progression (AP)
5. Solve problems on an AP

Previous knowledge: students can solve problem on number line.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, what is the next term in the series 4, 2, 0 ? The teacher answers the question after the response of the students. The next term of 4, 2, 0 equals -2. The

concept of nth term and sum of an AP will be explored. Also, solution of different problems on an AP will also be examined.

Step1: The students are put into groups of about five students each heterogeneous in terms of gender, ethnicity, and academic ability by their teacher and have them numbered. Then leads the students on the meaning of series and sequence, AP, Nth term of an AP and sum of an AP then follow it with appropriate examples

A sequence is a rule which will give more terms in the list e.g. 1, 9, 25, 49 … when the terms of a sequence are added the resulting expression is called a series. e,g 1+2+3+4+…

A sequence in which terms either increase or decrease in equal steps is called an arithmetic progression (AP). The nth term of n arithmetic progression with a as the first term and d as the difference is given by $Un = a + (n - 1)d$

The sum of an AP with a as the first term, n as the number of terms, L as the last term and d as the common difference is given by

$S=x/2\ (a+L)$ & $S=x/2\{2a+(x-1)d$

Example1: Given the AP 9, 12, 15, 18, Find the (a) 8th term (b) nth term.

Step 2: The teacher allows each group to put their heads together to solve the problem and interact with one another in the respective group and ensure that every member in each of the team can solve the problem.

Step 3: A number at random is called by the teacher; students bearing the number raise their hands to respond and obtain points for each of their groups

Step 4: The teacher allows the groups to re-assess their operation and also change their strategies for enhancement and then proffer solution.

Step 5: The teacher gives the students another problem to solve and repeat steps 2, 3, and 4 For example, find the addition of the first 10 terms of AP 16 + 9 + 2 + (-5) + ……..

Evaluation:

1. A sequence of an AP is 6, 4, 2, ---------- find its nth term
2. An AP has its 18^{th} term to be 25 and common difference of 2. Calculate its first term.
3. Calculate the sum of the series; 50+49+48+----------+2+1.

Step 6: The teacher allows the students to do their exercise individually, mark their notes in the process and finally do the corrections with them.

Step 7: The teacher summarises the whole lesson and gives the following problems to solve assignment.

1. Calculate the next two terms of the sequence; 27, 9, 3, 1, $\frac{1}{3}$, $\frac{1}{9}$, ----------

2. Find the number of terms in an AP given that its first and last term are a and 37a respectively and that it's common difference is 4a

3. An AP has 15 terms and a common difference of -3. Find it first and last term, if its sum is 120.

Remarks:

Week 7

Class: SS2

No. of students:

Topic: Arithmetic processes

Subtopic: Geometric progression

References Book: New General Mathematics

No. of students: 42

Average age of students: 15 years

Instructional Materials:

Learning objectives: By the end of the lesson, students should be able to

1. Define a geometric progression

2. Calculate the nth term of GP

3. Calculate the sum of GP

4. Calculate the sum to infinity of GP

Previous Knowledge: Students can solve problem on a sequence and series.

Introduction: The Teacher drills the student with simple question to refresh their memory. For example, what are the next two terms in the series:

1 + 4+ 9 + 16 + 25. The teacher answers the questions after the student response. The next term of 1+4+9+16+25 are 36 +49+64.

The concept of nth term and the sum of GP will be explored. Also, solution of different forms of GP will also be examined.

Step1: The teacher asks the students to form a group of five students each which has to be heterogeneous in terms of gender, ethnicity, and academic ability and number themselves. Then leads the students on the meaning of GP, Nth term of a GP and sum of an GP and sum to infinity of a GP then follows it with appropriate examples and give the students the problem to solve.

A sequence in which terms either increase or decrease in common ratio is called geometric progression (GP). The nth term of n GP is given by $U_n=ar^{n-1}$, the sum of a GP is given by $S=a + ar^2 + ar^3 + ar^4 + ar^{n-1}$...(1)

$rS= ar + ar^2 + ar^3 + ar^4 + …. + ar^n$ …(2)

Subtract two from one

$S - rS = a - ar^n$

$S(1 – r) = a (1 - r^n)$

$S = \frac{a (1 – r^n)}{1 – r}$ …….. (1)

Multiply numerator and denominator by -1

$S = \frac{a (r^n – 1)}{r – 1}$ ……(2)

if r < 1 (1) is more applicable if r > 1 (2) is more applicable. $S_\infty = \frac{a}{1-r}$. Given the geometric progression 5, 10, 20, 40, 80, … Find its (a) 9th (b)nth term

Step 2: The teacher allows each group to put their heads together to solve the problem and interact with one another in their respective group and ensure that every member in the group can solve the problem

Step 3: A number at random is called by the teacher; students bearing the number raise their hands to respond and obtain points for each of their groups

Step 4: The teacher allows the groups to re-assess their operation and also change their strategies for enhancement later and the teacher later solves the problems.

Step 5: The teacher gives the students another problem to solve and repeat steps 2, 3, and 4. For example, calculate the sum of GP: 2 + 6 + 18 + 54 + …… + 1458.

Evaluation:

1. A GP has its 6th term to be 2000. Find its first term if its common ratio is 10.

2. The first term and the common ratio of a GP are respectively 5 and 2.Calculate its nth term.

3. A GP has 8 terms. Its first and last term is 0.3 and 38.4. Compute the addition of the terms of the GP

Step 6: The teacher allows the students to solve the problem individually, mark their notes in the process and finally do the corrections with them.

Step 7: The whole lesson is summarised by their teacher and gives the following questions to students to solve as assignment.

1. A GP has $-\frac{7}{32}$ as its 8^{th} term and a first term of 28.find its common ratio.

2. Find the number of terms in a GP given that its first term and last terms are $5\frac{1}{3}$k and $\frac{243}{256}$k respectively and that the common ratio is $\frac{3}{4}$

3. The 2nd and 5th terms of a GP are -7 and 56 respectively. Calculate its total of the first five terms

4. Compute the addition to infinity of the GP $1+\frac{1}{2}+\frac{1}{4}+\ldots\ldots$ Remarks:

Lesson note on conventional strategy: Week1

Class: SS2

Topic: Linear equation

Subtopic: Word problem leading to linear equation

Duration: 40 minutes

Reference book: Comprehensive mathematics for senior secondary school. Page: 60-62.

Learning Objective: By the end of the lesson, students should be able to solve word problems leading to linear equation

Previous Knowledge: Students can solve problem on linear equation.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example**,** the teacher asks the students to mention the additive inverse of +5 and -5

+5 is the additive inverse of -5 and -5 is the additive opposite of +5.In finding the additive opposite of positive sign (+) it is changed to negative sign (-) and vice versa. In finding the multiplicative inverse, the given number is inverted. For example the multiplicative inverse of SS2/3 is 3/2. The concept of Linear equation and its word problem will be explored in this lesson. Interpretation of word problem leading to linear equation and its solution will be examined.

Step I: The teacher drills the students by asking simple question to refresh their memory. For example the teacher asks the student to solve 3(y+3) = 8y+10

Step 2: The teacher leads the students to solve some problems as examples

Example 1: one third of a number added to four – fifth of its self is equal to 17. Find the number.

Solution:

Let the number be x $\frac{1}{3}$ x $\times \frac{4}{5}$x =17

Multiply through by 15

$\frac{1}{3} x \times 15^{5} + \frac{4x}{5} \times 15^{3} = 17 \times 15$

$5x + 12x = 255$

$17x = 255 \qquad x = 15$

Example 2: A dad is four fold as old as his child; in the next four years he will be three fold as old .calculate their current ages.

Solution:

Let the ages of the son and the father be a *and* b respectively

$$b = 4a$$

$$b + 4 = 3(a + 4)$$

$$b + 4 = 3a + 12$$

$$4a + 4 = 3a + 12$$

$$a = 8. \qquad b = 4a = 4 \times 8 = 32$$

Step 3: The students are given opportunity to copy the note from the chalkboard ask question if any then give the following questions to solve as exercise.

1. When 189 are removed out of five times a particular integer it is equivalent to one-portion of the original integer. Calculate the integer.

2. A mum is threefold as old as her child. In the next 12 years she will be twice as old. Calculate the mum current age

Step 4: The students are given the opportunity to ask some questions, seeking clarification on areas that is not clear to them.

Step 5: The teacher gives the students some questions to solve as exercise.

Step 6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Step 7: The whole lesson is summarised by their teacher and give the following questions to solve as assignment,

1. A rectangle is 68cm^2 in area and with a perimeter of 42cm.Find the breadth of the rectangle.

2. A two digits integer is such that seven times the unit digit is 8 greater than twice the tens digit. When the digits are interchanged the integer is decreased by 9, calculate the integer

Remarks:

Week 2

Class: SS2

Topic: Simultaneous equation

Subtopic: Word problem leading to simultaneous equations

Duration: 40 minutes

Reference book: Comprehensive school by D.B Adu. Page 80-81

Learning Objectives: By the end of the lesson, student should be able to:

I Translate word problem leading to simultaneous equation into mathematical statements

ii. Solve the translated statements correctly

Previous knowledge: students can solve problem on simultaneous equation.

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, the teacher asks the students to solve 1/3x + 4/5x = 17. 1/3x X 15 +4x/5 X 15 =17 X 15. 5x + 12x =255. 17x = 255. X = 15.

The interpretation of word problem leading to simultaneous equation will be explored in this lesson. The solution of the transformed problem will also be examined.

Step 1: The students answer the teacher question. The teacher provides a brief solution.

Step 2: The teacher leads the students to solve some questions as example, the addition of two certain numbers equals 8, the product of the two numbers equals 15, find the numbers

Solution: Let the two numbers be $a \ and \ b$

$a + b = 8 - -1$

$ab = 15 - -2$

$a = 8 - b - -3$

$(8 - b) - b^2$ =15

$b^2 - 8b + 15 = 0$

$b^2 - 5b - 3b + 15 = 0$

b (b-5)-3(b-5) =0

(b - 5) (b - 3) =0

b - 5 = 0 ~~b~~= 5

b – 3 = 0 b= 3

Example 2: A two digits integer is such that fourfold the unit digit is 5 greater than threefold the ten's digit. When the digits are reversed the integer improved by 9.Calculate the integer.

Solution: Let the two digits be x *and* y such that x *is ten's digit and* y *is unit .*

therefore the number is 10 $x + y$

$4y = 3x + 5$-------- 1

$10x + y = 10y + x + 9$

$10x - x + y - 10y = 9$

$9x - 9y = 9$

$x - y = 1$

$x = y + 1$

4y = 3 (y +1) + 5

4y = 3y + 3+ 5

Y = 8

$x = 8 + 1 = 9$

$10x + y = 10\ (9) + 8 + 98.$

Step 3: Students are allowed to copy the note from the chalkboard by their teacher.

Step 4: The teacher allows the students to ask question, seek clarification on the area that are not clear to them.

Step 5: The Teacher gives the students some questions to solve as exercise.

1. Two numbers add up to 13; their product is 40.Calculate the numbers.

2. A number contains two digits was added by 9.If the digits of the number are interchanged, the addition of the two digits equals 5.Calculate the integer

Step 6: The Teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Step 7: The teacher summarises the whole lesson and give assignment.

1. A two digits integer has its sum to be 8. The difference between these integers and the digits interchanged equals 54.Find the integer.

2. A dad is three fold as old as his child. Nine years a while back, the father was fourfold as the child. Calculate their current ages.

Remarks:

Week 3

Class: SSS 2

Topic: Quadratic Equation

Sub-topic: Word problem leading to Quadratic equation

Duration: 40 Minutes

Reference book: MAN Mathematics for Senior Secondary School (2)

Learning Objectives: By the end of the lesson, students should be able to solve word problem on quadratic equation.

Previous knowledge: Students can solve problems on quadratic equation using the formula method.

Introduction: The teachers drills the students by asking simple question to refresh their memory, for example, the teacher asks the students to solve 3(y +2) = 8y +10.

3(y+2) = 8y +10.

3y + 6 =8y+10.

-5y = 4.

y = -4/5.

The concept of word problem leading to quadratic equation will be explored. Interpretation of word problem into mathematical equations and their solutions will be examined.

Step 1: The students answered the question asked by the teacher. The Teacher later provides a brief answer.

$x^2 + 6x + 9 = 0$

Step 2: The students are led by their teacher to solve the under listed examples on the chalkboard.

Example 1: The product of two numbers is 40 and their sum is 13. Calculate the numbers

Solution

Let the numbers be a & b.

ab = 40 …….(1)

a+ b = 13……(2)

from (2) b = 13 – a……(3)

put (3) in (1)

ab = 40

a(13-a) = 40

$13a – a^2 = 40$

$a^2 – 13a + 40 = 0$

$a^2 – 8a – 5a + 40 = 0$

a(a – 8) – 5(a – 8) = 0

(a – 5) (a – 8) = 0

a – 5 = 0 => a =5. a – 8 = 0 => a = 8.

When a =5, b = 13 – a = 13 - 5 = 8. When a = 8, b = 13 – a = 13 – 8 = 5.

Therefore, the two numbers are 5 & 8

Example 2:- A rectangle has its breadth 3cm less to the length; if its area equals $88cm^2$. Calculate its breadth.

Solution

Let the breadth and length of the rectangle be represented as b and l respectively.

b = l – 3

A = l x b

$= l (l – 3) = 88$

$= l^2 – 3l – 88 = 0$

$l^2 – 11l + 8l – 88 = 0$

l (l – 11) + 8(l – 11) = 0

l + 8 = 0 or L – 11 = 0

l = -8 or 11

l = 11. When l = 11, b = l – 3, b = 11 – 3 = 8cm

Step 3: The Students seek clarification on some question not cleared to them.

Step 4: The students are given the opportunity to copy the note from the chalkboard.

Step 5: The teacher gives the following questions to solve as exercise

(1) Two numbers add up to 44 and their product is 483, calculate the numbers

(2) The length of a rectangle is 2m longer than the breadth. If its area is $8m^2$; find the breadth.

Step 6: The Teacher allows the students to do the exercise individually mark their notes in the process and finally do the corrections with them.

Stage 7: The teacher summarises the lessons and allowed the students to ask question if any, then give the following questions as assignment

(1) If 5times a particular integer is removed out of twice the square of the integer, it equals to 63. Calculate the integer.

(2) A mum is threefold as old as her child.10 years a while back, their product age was 532, calculate the current age of the mum.

Remarks:

Week 4

Class: SSS 2

Topic: Arithmetic processes

Subtopic: Proportions

Duration: 40 minutes

Reference book: Comprehensive mathematics for senior secondary school by D.B Adu. Pg. 24-25

Learning Objectives: By the end of the lesson, students should be able to:

(i) State the meaning of proportion correctly

(ii) Solve problems on proportion accurately

Previous knowledge: Students can solve problem on ratio

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, which of these ratios is greater 16:7 or 7:16?

The concept of direct, inverse, and complex proportion will be examined. The calculations of different types of proportions will also be explored.

Step 1: The students answered the question asked by the Teacher. The teacher later provides a brief answer.

Step 2: The students are led on the meaning of proportion and its different forms and then follows it with appropriate examples. Proportion is a method of showing the relative comparison of two or more quantities. It normally contains unit. There are three types of proportions, namely simple or direct, inverse and complex proportions .Direct proportion compares two quantities such that when one increases or decreases the other one also

increases or decreases. In inverse proportion, as one quantity increases the other decreases and vice-versa. On the other hand, complex proportion involves combination of two or more simple or inverse proportions or both with more than two quantities.

Example 1: A car uses 172 litres of fuel for a distance of 2965km. How many litres of fuel will be needed for a distance of 500km?

Solution

2965km $\longrightarrow$ 172 litres

1km $\longrightarrow$ $\frac{172}{2965}$ litres

500km $\longrightarrow$ ($\frac{172}{2965}$ x 500)

29.00506

$\sim$ 29litres.

Example 2: The erection of a tower takes as 24man to complete in 15days. How many days will a man take to erect the tower when working at the same rate?

Solution:

24 men completed it in 15days. 1 man complete it in 24 x 15days a man complete it in 24 x 15d

= 40days

Step 3: The students are allowed to copy the note from the chalkboard.

Step 4: The Teacher allows the students to seek clarification on areas that are not clear to them.

Step 5: The students are given questions to solve as exercise.(a) A man runs 6km journey for 2hours. How long will it takes him to run 9km.

(2) 9 man can do a job in 28days (a) calculate the time it take 14men to do the job (b) How many men will do it in 56 days?

Step 6: The teacher allows the students to do the exercise individually mark their notes in the process and finally do the corrections with them.

Step7: The whole lesson is summarised by their teacher and the students are given the opportunity to ask question if any, then give the following questions to solve as assignment

(1) If a car can drives 80km per hour in 5hours and another 60km per hour in 4hours.Compute the average velocity for the entire journey.

(2) It takes 48men to do a piece of job in 30days.Calculate the time it takes 18men to do the same job if they work at the same pace.

Remarks:

Week 5

Class: SSS 2

Topic: Arithmetic process

Sub-topic: Ratio and percentage

Duration: 40 minutes

Reference book: Comprehensive mathematics for senior secondary schools by D.B Adu. Pg. 23-27

Behavioural Objectives: By the end of the lesson, students should be able to:

(i) Differentiate ratio and percentage correctly

(ii) Solve word problem involving ratio and percentage.

Previous knowledge: Students can distinguish numerator from denominator

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, what is the denominator and numerator in $\frac{P}{Q}$?

The numerator is p, while the denominator is q. The concept of percentage increase and decrease, gain and loss as well as percentage error will be explored; also their interpretations into mathematical statements and solutions will also be examined.

Step 1: The student answered the question asked by the teacher. The teacher later provides a brief answer.

Step 2: The students are led on the meaning of ratio and percentage and follows them with appropriate examples. Ratio is a numerical method of comparing two quantities that are of the same type e.g. Marks, length, weight, ages among others.

A percentage is another form of fraction proportion. It is a part of one hundred units. It can also be viewed as ratio whose denominator is 100.

1. A particular class comprises 40 men and some women. In the event that men to women ratio is 2:5.Find the population of women in the class.

Solution

Let the number of women be represented as n.

$\frac{2}{5} = \frac{40}{n}$

2n = 5 x 40 = 200

n = 100

Example 2: A firm produces 3500 articles last years, but this year it is 2975 articles. Find the percentage decrease in the production.

Solution

Last year production: 3500

This year production = 2975

% decreases = $\frac{3500-2975}{3500}$ x 100

= 15%

Step 3: The students are given the opportunity to copy the note from the chalkboard.

Step 4: The students ask question, seek clarification on areas that is not clear to them.

Step 5: The teacher gives the students questions to solve as exercise.

1. In preparing a recipe for cake, the flour to sugar ratio is 40:3. Find the amount of flour to 18kg of sugar.

2. A man's wages increased from N6250 to N7125 per month.

(a) Find the percentage increase

(b) If the wages are taxed at 12%, find the increase in tax payable

Step 6: The teacher allows the student to do the exercise individually mark their notes in the process and finally do the corrections with them.

Step 7: The whole lesson is summarised by their teacher and give some questions to solve as assignment.

1. A dad and his child ages are in the ratio 8:5. If the child's age now is15. Compute the dad's age 6 years ago

2. When the weight of a baby decreases by 16%, it becomes 10.5kg. Find what the weight would have been if it increased by 90%.

Remarks: ⟶

Week 6

Class: SS2

Topic: Arithmetic processes

Subtopic: Arithmetic progression

Duration: 40minutes

References Book: Macrae M.F et al

No of students……..

Average age…….

Learning objectives: By the end of the lesson, students should be able to

1. Define series and sequences and examples
2. Define arithmetic progression and give examples
3. Calculate the nth term of an AP
4. Calculate the sum of an arithmetic progression (AP)
5. Solve problems on an AP

Previous Knowledge: Students can solve problem on number line.

Instructional Materials:

Introduction: The teacher drills the students by asking simple question to refresh their memory. For example, what is the next term in the series 4, 2, 0 ? The teacher answers the question after the response of the students. The next term of 4, 2, 0 equals -2. The concept of mth term and addition of an AP will be explored. Also, solution of different problems on an AP will also be examined.

Step I: The students answered the question posed by the teacher. The teacher later provides brief answer.

Step 2: The students are led on the meaning of series and sequence, arithmetic progression (AP), in the term of an AP and sum of AP then follow it with appropriate examples. A sequence is a rule which will give more terms in the list e.g 1, 9, 25, 49, ----- when the terms of a sequence are added, the resulting expression is called a series e.g 1+2+3+4+……

A sequence in which terms either increase or decrease in equal steps is called an arithmetic progression (AP). The nth term of n arithmetic progression with a as the first term and d as the difference is given by Un =a + (n – 1)d

The sum of an AP with a as the first term, n as the number of terms, L as the last term and d as the common difference is given by

S=x/2 (a+L) & S=x/2{2a+(x-1)d}

Example1: Given the AP 9, 12, 15, 18, Find the (a) 8th term (b) nth term.

Solution a=9, d=3, n=8

(a) U_8 = a+ (8-1)d = 9 + 7 X 3 =30

(b) U_n = a+ (n-1)d

= 9+(n-1)3

=9 +3n-3= 6+3n

Example2: Calculate the addition of the first 20 terms of AP 16 +9+2+(-5) + ……

Solution: a=16, d=-7, n=20.

S= n/2 {2a + (n-1)d}

=20/2 {2X16+(20-1)-7}

=10(32-133)

=-1010

Step 3: The students are allowed to copy the note from the chalkboard.

Step 4: The Teacher allowed the students to ask questions, seek clarification of areas that is not clear to them.

Step 5: The Teacher gives students the following questions to solve as exercise.

1.A sequence 6, 4, 2, ---------- has a common difference of -2.Calculate its nth term.

2. An AP has 25 as its 18^{th} term and a common difference of 2. Calculate its first term.

3. Find the sum of the series; 50+49+48+----------+2+1.

Step 6: The teacher allows the students to do the exercise individually mark their notes in the process and finally do the corrections with them.

Step 7: The teacher summarises the whole lesson and allowed students to ask question if any, then give some questions to solve as assignment

1. Calculate the next two terms of the sequence; 27, 9, 3, 1, $\frac{1}{3}, \frac{1}{9}$, ----------

2. Find the number of terms in an AP given that its first and last term are a and 37a respectively and that it's common difference is 4a

3. An AP has 15 terms and a common difference of -3. Find it first and last term, if its sum is 120.

Remarks:

Week 7

Class: SS2

Topic: Arithmetic processes

Subtopic: Geometric progression

Duration: 40minutes

References Book: New general mathematics for senior secondary school

Macrae M.F et al pp:177-187

No. of students……..

Average age…

Instructional Materials…

Learning objectives: By the end of the lesson, students should be able to

1. Define a geometric progression
2. Calculate the nth term of GP
3. Calculate the sum of GP
4. Calculate the sum to infinity of GP

Previous Knowledge: Students can solve problem on a sequence and series.

Introduction: The Teacher drills the students with simple question to refresh their memory. For example, what are the next two terms in the series: 1 + 4+ 9 + 16 + 25.The concept of nth term and the sum of GP will be explored; also, solution of different forms of GP will be examined

Step 1: The students answered the question asked by the teacher. The teacher later provides brief answer.

Step 2: The students are led on the meaning of GP, sum to infinity then follows it with appropriate examples.

A sequence in which terms either increase or decrease in common ratio is called geometric progression (GP). The nth term of n GP is given by $U_n=ar^{n-1}$, the sum of a GP is given by $S=a + ar^2 + ar^3 + ar^4 + ar^{n-1}$...(1)

$rS= ar + ar^2 + ar^3 + ar^4 + \ldots. + ar^n$ …(2)

Subtract two from one

$S - rS = a - ar^n$

$S(1 – r) = a (1 - r^n)$

$$S = \frac{a(1 – r^n)}{1 – r} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Multiply numerator and denominator by -1

$$S = \frac{a(r^n – 1)}{r – 1} \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

if r < 1 (1) is more applicable if r > 1 (2) is more applicable. $S_\infty = \frac{a}{1-r}$

Example1: Given the geometric progression 5, 10, 20, 40, 80, … Find its (a) 9th (b)nth term

Solution: a=5, r=2, n=9

(a) $U_9 = ar^{n-1} = 5 \text{ X } 2^{9-1} = 5 \text{ X } 2^8 = 1280$

(b) nth term =? $U_n = ar^{n-1}$

$=5(2^{n-1})$

Example 2: Find the sum of the GP: 2 + 6 + 18 + 54 + … + 1458.

Solution: a =2, r = 6/2 =3

$U_n= ar^{n-1}$

$2X3^{n-1} = 1458$

$3^{n-1} 729 = 3^6$

n-1=6 = 7.

$$S = \frac{a(r^n – 1)}{r – 1}$$

$$= \frac{2(3^7 – 1)}{3 – 1}$$

$= (2187 – 1) = 2186.$

Example 3: A GP has 60 as its sum to infinity and 12 as its first term. Find its second term.

Solution: S_∞=60, a =12, r=?

$S_\infty = \frac{a}{1-r} = \frac{12}{1-r}$

60(1 – r) =12

$1 - r = \frac{12}{60} = \frac{1}{5}$

$r = 1 - \frac{1}{5} = \frac{4}{5}$

Second term = ar = 12 X 4/5 = 9.6

Step 3: The students are given the opportunity to copy the note from the chalkboard.

Step 4: The Teacher allowed the students to ask question, seek clarification on areas that are not clear to them.

Step 5: The teacher gives the following questions to solve as exercise.

1. A GP has its 6^{th} term to be 2000. Calculate its first term if its common ratio is 10.

2. A GP with its first term as 5 and 2 as its common ratio. Calculate its nth term

3. A GP has 8 terms. Its first and last term is 0.3 and 38.4.Compute the addition of the terms of the GP

Step 6: The teacher allows the students to do the exercise individually, mark their notes in the process and finally do the corrections with them.

Step 7: The teacher summarises the whole lesson and allowed students to ask question if any

Then, give some questions to solve as home work

1. If $-\frac{7}{32}$ is the 8^{th} term of a GP. Compute the common ratio of the GP if it has a first term of 28.

2. Find the number of terms in a GP given that its first term and last terms are $5\frac{1}{3}$k and $\frac{243}{256}$k respectively and that the common ratio is $\frac{3}{4}$

3. The second and fifth terms of a GP are -7 and 56. Calculate the addition of its first five terms

4. Calculate the addition to infinity of the GP: $1+\frac{1}{2} + \frac{1}{4} + \ldots$

Remarks:

Appendix V

MATHEMATICS WORD PROBLEM ATTITUDE SCALE (MAWPAS)

Name _____*School*

_____

Directions: This inventory consists of statements about your attitude toward mathematics word problem. There are no correct or incorrect responses. Read each item carefully. Please think about how you feel about each item. Enter the response that closely corresponds to how each statement best describes your feelings. Please answer every question.

PLEASE USE THESE RESPONSE CODES: A – Strongly Disagree
B – Disagree
C – Agree
D – Strongly Agree

1.	Mathematics word problem is a very worthwhile and necessary topic	
2.	I want to develop my mathematical word problem skills	
3.	I get a great deal of satisfaction for solving a mathematics word problem	
4.	Mathematics word problem helps develop the mind of a person to think	
5.	Mathematics word problem is important in everyday life	
6.	Mathematics word problem is one of the most important topic for people to study	
7.	High school Mathematics word problem course would be very helpful no matter what decide to study	
8.	I can think of many ways that I use Mathematics word problem outside of school	
9.	Mathematics word problem is one of my most dreaded topic	
10.	My mind always goes blank with mathematics word problem and l am unable to think clearly when working	

11.	Studying mathematics word problem makes me feel nervous	
12.	Mathematics word problem word me feel uncomfortable.	
13.	I am always under a terrible strain in a mathematics word problem class.	
14.	When l hear the word mathematics word problem, l have a feeling of dislike.	
15.	It makes me nervous to even think about having to do a mathematics word problem	
16.	Mathematics word problem does not scare me at all.	
17.	I have a lot of self-confidence when it comes to mathematics word problem.	
18.	I am able to solve mathematics word problem without too much difficulty.	
19.	I expect to do fairly well in any mathematics word problem class l take.	
20.	I learn mathematics word problem easily.	
21.	I am confident that l could learn advanced mathematics word problem.	
22.	I have usually enjoyed studying mathematics word problem in school.	
23.	Mathematics word problem is dull and boring.	
24.	I like to solve new problems in mathematics word problem.	
25.	I would prefer to do an assignment in mathematics word problem than to write an essay.	
26.	I would like to avoid using mathematics word problem in college.	
27.	I really like mathematics word problem.	
28.	I am happier in a mathematics word problem class than in any other class.	
29.	Mathematics word problem is a very interesting topic.	
30.	I am willing to take more than the required amount of mathematics word problem.	
31.	I plan to take as much mathematics word problem as l can during my education.	

32.	The challenge of mathematics word problem appeals to me.	
33.	I think studying advanced mathematics word problem is useful.	
34.	I believe studying mathematics word problem helps me with problem solving in other areas.	
35.	I am comfortable expressing my own ideas on how to look for solution.	
36.	I am comfortable answering questions in mathematics word problem class.	
37.	I believe I am good at solving mathematics word problem.	

Adapted from Martha Tapia 1996

APPENDIX VI

MATHEMATICS WORD PROBLEM ACHIEVEMENT TEST (MAWPAT)

1. A metal is composed of copper and zinc in the ratio 3:2 by volume. Find the volume of a piece of the metal that contains 42cm^3 of copper (a) 75cm^3 (b) 72cm^3 (c) 70cm^3 (d) 68cm^3

2. As a result of inflation, a trader increases her prices in the ratio 19:17. What will be the new price of a watch marked at ₦3570? (a) ₦3870 (b) ₦3970 (c) ₦3990 (d) ₦4990

3. The population of boys in a mixed school is 280. The boys to girls' ratio are 4:5. Calculate the population of students in the school (a) 350 (b) 450 (c) 580 (d) 630

4. The father ages and his child are in the ratio 8:3. If the child's age now is 12, what will be the ratio of their ages in 4 years' time? (a) 9:4 (b) 10:7 (c) 10:3 (d) 11:7

5. Each week, a person works from 8:00 am to 12:30 pm on two days and from 2:00pm to 5:12 pm on five days. The rate of pay is N595 per hour. What is the person's total weekly wage? (a) N5875 (b) N14875 (c) N13875 (d) N1268

6. A and B contribute ₦140000 and ₦150000 respectively in a business partnership. Of the profit A receives 20% as a manager and the rest is shared in the ratio of their capital. What is the ratio of A's total share of the profit to B's? (a) 12:6 (b) 11:9 (c) 10:7 (d) 9:5

7. Alfred spends ¼ of his money on food, 1/3 on clothing and saved the rest if he saved ₦72000.00, how much did he spend on food? (a) ₦43200 (b) ₦53200 (c) ₦68500 (d) ₦79800

8. Three quarters of an integer added to two and a half of that integer gives 13. Find the integer (a) 2 (b) 3 (c) 4 (d) 5

9. Obi has four times as many sweets as Olu. If Obi gives 21sweets to Olu, they will have equal number of sweets. How many sweets has Obi? (a) 14 (b) 21 (c) 56 (d) 64

10. When the price of an apple increased by ₦5.00, 18 apples cost ₦60.00 more than 20 apple cost before the increase. Find the new price of an apple (a) ₦15 (b) ₦20.00 (c) ₦25.00 (d) ₦30.00

11. In a digit integer, the addition of the digits is 8. The difference between this number and the number with the digits interchanged is 54.Calculate the integer? (a) 82 (b) 71 (c) 21 (d) 17

12. A man's age and his son's add up to 45years. Five years ago the man was 6times as old as his son. How old was the man when the son was born? (a) 15 (b) 20 (c) 25 (d) 35

13. In an examination, Adenike obtained 19marks more than Musa. If Adenike had obtained one and a half times her own mark, she would have scored 6marks more than twice Musa's mark. Find the mark scored by Musa (a) 64 (b) 45 (c) 40 (d) 25

14. A student cycles for x hours at 12kmh^{-1} and y hours at 16kmh^{-1}. Altogether, the student cycles 66km in 5hours. Find x and y (a) $3^1/_2$, 2 ½ (b) 3 ½, 1 ½ (c) 3, 2 (d) 4 $^1/_2$, 2 ½

15. The difference between the digits of a two digits' integer is 1. The integer itself is 1 more than 5times the sum of its digits. If the unit's digit is greater than the tens digit, calculate the integer (a) 56 (b) 46 (c) 37 (d) 34

16. Find the two numbers which differ by 4 and whose product is 45. (a)11, 4 (b)9, 4 (c)9, 5 (d) 8, 4

17. Calculate the two consecutive odd numbers with a product of 195.(a)-16,17 (b)13, 15 (c)16, 18 (d)17, 19

18. A woman is 3 times as old as her son. 8 years ago, the product of their ages was 112.What is their ages now (a) 32, 12 (b) 40, 15 (c) 45, 15 (d) 55, 18.

19. The base of a triangle is 3cm longer than its corresponding height. If the area is $44cm^2$, find the length of its base. (a) 8cm (b) 9cm (c) 10cm (d) 11cm.

20. Twice a particular whole number subtracted from 3times the square of the number leaves 133. Find the number (a) 6 (b) 7 (c) 8 (d) 9.

21. A girl is 6years younger than her brother. The product of their ages is 135. Find their ages. (a) -10, 6 (b) 15, 9 (c) -8, 4 (d) -7, 3.

22. A man is 37years old and his child's age is 8. How many years ago was the product of their ages 96? (a) 4 (b) 5 (c) 6 (d) 7.

23. Ali and Taiwo share 735 naira between them so that Ali gets 95 naira more than Taiwo. Calculate the amount each gets (a) 450, 350 (b) 420, 340 (c) 415, 320.

24. A trader buys some eggs at ₦15 each. She finds that five of them are broken. She sells the rest at ₦20 each and makes a profit of ₦340. How many eggs did she buy? (a) 88 (b) 89 (c) 90 (d) 91

25. If I can ride a bicycle at a rate of $5ms^{-1}$. How long will it take me to ride a distance of 12km at the same rate? (a) 38min (b) 39min (c) 40min (d) 41min

26. The first and the last term of an A.P: are 6.7and 17.1 respectively. If there are 14 terms in the sequence. Find its common difference. (A)0.6 (B)0.7 (C) 0.8 (D)0.9

27. Calculate the numbers of terms in an A.P given that its first and last terms are a and 37a respectively and that its common difference is 4a. (A) 10 (B) 9 (C) 8 (D) 7

28. A GP has a common ratio of 2 and first terms of 5 calculate its nth term. (A) $2\times5^{n-1}$(B) $3\times^{5n-1}$ (C) $4\times^{5n-1}$ (D) $5\text{-}2^{n-1}$

29. A G.P has 8terms. Its first and last terms are 0.3 and 38.4 respectively. Calculate the sum of the terms of the G.P (A) 46.5 (B) 56.5 (C) 66.5 (D) 76.5

30. Ali and Ojo invest ₦70000 and ₦140000 in a business. The profit is shared bet ween them in the ratio of their investment. The profit in the first year is ₦51840. How much does Ali get? (A) ₦34560 (B) ₦1828 (C) ₦17280 (D) ₦16280

APPENDIX VII

VERBAL ABILITY TEST

This is a test to perceive how well you can think. It contains inquiries of various types. A few models and practice questions will be given to tell you the best way to respond to the inquiries. Compose your response in the response sheet gave.

You will have 30 minutes to do the test. A few inquiries are more straightforward than others. Attempt each inquiry as you come to it, however in the event that you find any inquiry is excessively hard, forget about it and return to it later assuming that have opportunity and energy. Try not to invest an excess of energy on any one inquiry. Attempt to get whatever number freedoms as could be allowed.

Model A: Four of the accompanying things are comparative somehow or another. Compose the quantities of the other two in the sections. (1) tea (2) espresso (3) shoes (4) cocoa (5) pencil (6) milk (3 and 5)

Question 1: (1) pear (2) apple (3) potato (4) banana (5) carrot (6) orange ( )

Question2: (1) pool (2) tidal pond (3) swamp (4) lake (5) bog (6) lake ( )

3. (1) observer (2) spectator (3) pundit (4) onlooker (5) creator (6) observer ( )

Model B: TOWEL is to WATER as Smudging PAPER is to

school (2)ink (3) composing (4)desk (5)pen (3)

Question 4: HAND is to FINGER as FOOT is to

leg (2) arm (3) toe (4) man (5) lower leg ( )

Question5: NEWSPAPER is to SEE as Remote is to

product (2) hear (3) dial (4) ear (5) hard of hearing ( )

Question6: VOICE is to Phone as LETTER is to

stamp (2) mail center (3) composing (4) reporter (5) encompass ( )

Question?: Courteous are to Way as Ethics are to

(1) governmental issues (2) pleasantness (3) affluent (4) ethical (5) in number ( )

Question 8: Sea is to LAKE as Mainland is to

(1) sky (2) land (3) mountain (4) island (5) Africa ( )

Question 9: Make a beeline for PIN as NEEDLE is to

(1) prick (2) sew (3) eye (4) point (5) danger ( )

Question 10: Cinders is to Intensity as CAPENTRY is to

(1) craftsman (2) sawdust (3) chest (4) furnishings (5) wood ( )

Question11. In the event that these words were re-organized accurately to frame a sentence, with what letter could the center word start?

Is from a Molehill a Mountain A Thing Unique ( )

Question 12: Which two of the accompanying assertions mean generally almost something very similar?

Imprudent expert makes a careless worker

To oppose him that is set in power is underhanded

Little is done when many order

At the point when the feline is away the mice truly do play

Where there are seven shepherds there is no rush ( )

Question 13: Which of the two following assertions mean generally almost something similar?

Frivolous costs void the tote

Little acquires brings wealth

Indeed, even the feeble are solid when joined together

Consistent trickling erodes the stone

A chain is pretty much areas of strength for as its most fragile connection ( )

Question 14: Which of the two assertions demonstrate that "JOHN IS A Decent SWIMMER"?

Bounce goes to the showers regular

John and Bounce in a race a week ago

Bounce and John are companions

Bounce came out on top for last year's swimming title

John has provoked Bounce to a race ( )

Question 15: Which of the two assertions demonstrate that "MR. SMITH Possesses SOME TAMWORTHS"?

Tamworths are preferred pigs over Berksires

One-eighth of the pigs motel that pen are Tamworths

The majority of the pigs in that pen are Berkshires

Every one of the pigs in that pen have a place with Mr. Smith

The majority of the ranchers in the area own Tamworths

APPENDIX VIII

TEACHER EVALUATION SHEET FOR GROUP INVESTIGATION STRATEGY

Part 1: Background Information

Teacher:_____ School: _____

_____ Topic (s): _____

Class: _____

_____

Observation Date: _____ START TIME _____ End: _____

_____

Part II: Description of the Classroom

Student: Number of Males: _____ Number of Females _____

The Classroom Setting in which the lesson took place (Space, Seating Arrangements Environment and Personalization e.t.c).

Part III: Lesson Implementation.

Lesson steps	Performance Assessed	Very good 5	Good 4	Average 3	Below average 2	Poor 1
Step 1	Assigning students into task oriented group to choose variety of subtopics described first by the teacher					
Step 2	Planning of variety of learning procedures task, objectives in line with the chosen subtopics by the students					
Step 3	Carrying out a plan formulated in the second step using variety of learning activities and skill by the students					
Step 4	Analysis and synthesis of information to be presented in a decent form to the class by the students.					
Step 5	Presentations of different groups by the					

	students under the supervision of teacher					
Step 6	Evaluation of group presentation by teacher and students.					

Appendix 1X

TEACHER EVALUATION SHEET FOR NUMBERED HEADS TOGETHER STRATEGY

Part 1: Background Information

Teacher:_____ School: _____

_____ Topic (s): _____

Class: _____

_____

Observation Date: _____ START TIME _____ End: _____

_____

Part II: Description of the Classroom

Student: Number of Males: _____ Number of Females _____

The Classroom Setting in which the lesson took place (Space, Seating Arrangements Environment and Personalization e.t.c).

Part III: Lesson Implementation.

Lesson steps	Performance Assessed	Very good 5	Good 4	Average 3	Below average 2	Poor 1
Step 1	Assigning students into learning groups					
Step 2	Assigning of problems to students					
Step 3	Monitoring of students in solving the problem together and interacting with one another in their respective group					
Step 4	Calling of students at random to answer					

	the given question to earn point for their teams.					
Step 5	Evaluation					
Step 6	Assignment					

Appendix X

TEACHER EVALUATION SHEET FOR CONVENTIONAL STRATEGY

Part 1: Background Information

Teacher:_____ School: _____

_____ Topic (s): _____

Class: _____

Observation Date: _____ START TIME _____ End: _____

_____

Part II: Description of the Classroom

Student: Number of Males: _____ Number of Females _____

The Classroom Setting in which the lesson took place (Space, Seating Arrangements Environment an Personalization and so on).

Part III: Lesson Implementation.

Lesson steps	Performance Assessed	Very good 5	Good 4	Average 3	Below average 2	Poor 1
Step 1	Introduction of Topic					
Step 2	Presentation of lesson					
Step 3	Summarisation of lesson					
Step 4	Evaluation					
Step 5	Assignment					